1973-74

Undergraduate Catalog

For information about undergraduate admission to the University, students may contact:
Eugene A. Savage,
Director of Admissions

For information about courses and academic records, students and former students should contact:
Leslie C. Turner, Registrar

Cover Photo: Fred Bavendam
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University Calendar 1973-74

 Semester I 1973-74

September 9, Sunday
September 11, Tuesday
September 12, Wednesday
September 13, Thursday
September 28, Friday
October 5, Friday
October 11, Thursday

October 19, Friday
November 6, Tuesday

November 14, Wednesday
November 20, Tuesday
November 25, Sunday
November 26, Monday
December 14, Friday
January 2, Wednesday
January 3, Thursday
January 10-11, Thurs.-Fri.
January 14, Monday
January 24, Thursday
January 27, Sunday

8 a.m. Residence halls open
Registration; 4 p.m. First faculty meeting
8 a.m. Classes begin
1 p.m. Opening Convocation
Last day to drop courses without $10 late drop fee
Last day to add courses
Last day to carry over 20 credits without surcharge
or for partial tuition refund on withdrawal
Last day to opt for Pass/Fail
Mid-semester, last day to drop courses or withdraw
without academic liability
9 a.m. Mid-semester reports for freshmen due
7 p.m. Residence halls close, Thanksgiving
2 p.m. Residence halls open
8 a.m. Classes resume; pre-registration Sem. II begins
7 p.m. Residence halls close, Christmas
2 p.m. Residence halls open
8 a.m. Classes resume
Reading days
8 a.m. Semester I final examinations begin
6 p.m. Final exams end; 8 p.m. Residence halls close
Commencement

 Semester II 1974

February 2, Saturday
February 3, Sunday
February 4, Monday
February 15, Friday
February 22, Friday
March 5, Tuesday

March 8, Friday
March 22, Friday
March 31, Sunday
April 1, Monday
April 5, Friday

April 15, Monday
April 22, Monday
May 4, Saturday
May 11, Saturday
May 16-17, Thurs.-Fri.
May 20, Monday
May 27, Monday
May 28, Tuesday
May 31, Friday
June 2, Sunday

8 a.m. Residence halls open
Registration
8 a.m. Classes begin
Last day to drop courses without $10 late drop fee
Last day to add courses
Last day to carry over 20 credits without surcharge,
or for partial tuition refund on withdrawal
Last day to opt for Pass/Fail
7 p.m. Residence halls close, Spring Recess
2 p.m. Residence halls open
8 a.m. Classes resume
Mid-semester, last day to drop courses or withdraw
without academic liability
9 a.m. Mid-semester reports for freshmen due
8 a.m. Pre-registration for Semester I, 1974-75 begins
Classes hold Thursday schedule
Classes hold Friday schedule
Reading days
8 a.m. Semester II final examinations begin
Memorial Day holiday
9 a.m. Senior grades due
Final exams end, 8 p.m. Residence halls close
Commencement

The University reserves the right to modify the Calendar subsequent to printing.
Trustees

His Excellency Meldrim Thomson, Jr., LL.B.
Governor of New Hampshire
ex officio

Howard C. Townsend
Commissioner of Agriculture
ex officio

Commissioner of Education
ex officio

Thomas N. Bonner, B.A., M.A., Ph.D.
President of the University
ex officio

Harold E. Hyde, B.S., M.S., Ed.D.
President of Plymouth State College
ex officio

Leo F. Redfern
B.A., M.A., M.P.A., Ph.D.
President of Keene State College
ex officio

Mildred McAfee Horton
B.A., M.A., LL.D.
Randolph (1963-1975)
Chairman of the Board

Philip S. Dunlap, B.S.
Concord (1969-1974)
Vice-Chairman of the Board

Margaret R. Ramsay, B.Ed., M.Ed.
Keene (1971-1975)
Secretary of the Board

Bernard I. Snierson, A.B., LL.B.
Laconia (1963-1975)

Norman S. Weeks, B.S.
Laconia (1965-1973)

Richard W. Daland, B.S.
Nottingham (1966-1974)

Fred W. Hall, Jr., B.S., LL.B.
Rochester (1966-1973)

George T. Gilman, B.S.
Farmington (1967-1975)

Charles V. Spanos, B.A., LL.B.
Claremont (1967-1975)

Frederick C. Walker, B.S., Ed.M.
Dover (1968-1976)

John L. Saturley
Suncook (1970-1974)

Vivian H. Brown, B.Ed., M.B.A.
North Hampton (1971-1975)

Richard A. Morse, A.B. J.D.
Manchester (1971-1977)

David Alan Rock
Nashua (1971-1976)

Edna B. Weeks, B.S.
Greenland (1971-1973)

Paul J. Holloway, B.S.
Exeter (1972-1976)

Charles Wood, B.S.
Student Member
Plymouth (1972-1973)

Rye (1972-1976)
Principal Officers of Administration

Thomas N. Bonner, Ph.D.
President of the University

Norman W. Myers, B.S.
Vice-President-Treasurer

Eugene S. Mills, Ph.D.
Provost

Robert N. Faiman, Ph.D.
Vice-Provost for Research and Special Program Administration

David W. Ellis, Ph.D.
Vice-Provost for Academic Affairs

Allan B. Prince, Ph.D.
Vice-Provost for Budget and Administration

Richard F. Stevens, M.Ed.
Vice-Provost for Student Affairs

John B. Hraba, Ph.D.
Dean of the Office of Institutional Research and Planning

Maynard C. Heckel, Ed.D.
Dean of the School of Continuing Studies and Director of the Cooperative Extension Service

Andrew T. Mooradian, M.S.
Director of Department of Intercollegiate Athletics

W. Arthur Grant, B.A.
Executive Assistant to the President

C. Robert Keesey, B.A.
Ombudsman

Harry A. Keener, Ph.D.
Dean of the College of Life Sciences and Agriculture and Director of the Agricultural Experiment Station

Jan E. Clee, Ph.D.
Dean of the Whittemore School of Business and Economics

H. Trevor Colbourn, Ph.D.
Dean of the Graduate School

Richard S. Davis, Ph.D.
Dean of the College of Technology

Lawrence W. Slanetz, Ph.D.
Dean of the School of Health Studies

Allan A. Spitz, Ph.D.
Dean of the College of Liberal Arts

Jane E. Newman, M.Ed.
Dean of Students

Edward J. Durnall, Ed.D.
Director of the Division of Continuing Education

Donald E. Vincent, A.M.L.S.
University Librarian

Eugene A. Savage, M.Ed.
Director of Admissions

Leslie C. Turner, M.Ed.
Registrar

For officers of administrative divisions, see page 339.
The University is an equal opportunity/affirmative action employee.
General Information

Facts About the University

History

The University of New Hampshire, founded in 1866 as the New Hampshire College of Agriculture and the Mechanic Arts, was among the early state institutions of higher education made possible by federal government land grants to establish colleges serving the sons and daughters of farming and laboring families.

First located in Hanover as part of Dartmouth College, New Hampshire College moved to its present campus in Durham in 1893 after Benjamin Thompson, a prosperous farmer, bequeathed his land and money to further the development of the state college.

The College prospered in Durham, and in 1923 the State Legislature granted it a new charter as the University of New Hampshire, composed of the Colleges of Agriculture, Liberal Arts, and Technology. The Graduate School was formally added in 1928. The two-year program in agriculture which had been offered since 1895 was formally recognized in 1939 (now the Thompson School of Applied Science). In 1962, the Whittemore School of Business and Economics was established.

In 1963 the state's system of higher education was created when the former teachers' colleges at Plymouth and Keene were made divisions of the University and brought under the same Board of Trustees as the Durham campus. In 1969 the State Legislature recognized the extended functions of the College of Agriculture, renaming it the College of Life Sciences and Agriculture; and the School of Health Studies was established as part of the University at Durham.

Since 1967, the University has provided a widening range of undergraduate and graduate studies through its program at the Merrimack Valley Branch in Manchester, where development of a permanent campus is under way. In 1972, the School of Continuing Studies was created to coordinate the off-campus, educational programs of the University system institutions and to carry instructional services to communities throughout New Hampshire.
General Information

In the 1972-73 academic year, the University at Durham had 9,428 students enrolled. The State Colleges at Plymouth and Kcene had a combined enrollment of 4,683 students, and more than 2,000 students were enrolled in Merrimack Valley Branch programs.

Academic and cultural resources of each campus are amplified through System-shared programs and facilities. Cooperative ventures among the 10 member institutions of the New Hampshire College and University Council blend public and private higher education resources.

Physical Plant

The University campus in Durham covers 156 acres. There are 35 buildings devoted to instruction, research, and administration; 24 residence halls housing about 4,100 men and women; and three modern dining halls. Total University lands—including athletic fields and woodlots—comprise 3,500 acres. Book value of the physical plant exceeds $72 million. In addition to two new residence halls and a new dining hall, major construction completed during recent years includes:

University Library, with 650,000 volumes, 5,000 periodicals, and a substantial microfilm collection, has been expanded to accommodate up to one million volumes and to provide increased study area.

Whittemore School of Business and Economics occupies a new three-story building containing classrooms, seminar rooms, lecture halls, offices, and sophisticated business and technological equipment.

Parsons Hall, completed in 1970, provides modern facilities for the Department of Chemistry.

Athletics—Physical Education Facility, includes indoor swimming pool, track, and gymnasia. Snively Arena, an indoor ice hockey rink, also accommodates convocations and major cultural attractions.

Kendall Hall, a five-story building completed in the spring of 1970, is the home of the Animal Sciences Department with offices, classrooms, and laboratories. The library for the College of Life Sciences and Agriculture and for the Departments of Microbiology and Zoology is located on the first floor.

The New England Center, a cooperative effort by the six state universities of New England to provide outstanding continuing education programs throughout the region, is located at Durham. Offices for several regionally oriented educational organizations are in its administration center, and its new residence-dining-learning center provides modern facilities for adult education conferences and seminars.

Teaching, Service, and Research

The University of New Hampshire is committed to offering quality educational programs and first-rank educational opportunities for its students. At Durham, the University’s 512 full-time teaching faculty and
80 part-time professional specialists provide a ratio of one full-time faculty member for each 17 students. More than 75 per cent of the full-time faculty hold doctoral degrees, and many have earned national, even international, reputations in their professional fields.

A faculty member's first responsibility is to his students and to teaching. In the tradition of the nation's land-grant colleges, the University also encourages its faculty to contribute to the growth of man's knowledge through scholarly research and service to the community beyond the campus.

Accreditation

The New England Association of Schools and Colleges is the major accrediting body for the University of New Hampshire, and the University is a member in good standing of that Association. Specialized curriculum programs offered by the University are also accredited by various professional organizations.

Cultural Activities

With two theaters, two art galleries, and auditoriums (the largest seating up to 5,500 persons), the University is a major cultural resource for the entire state. The Spaulding Distinguished Lecture Series and the Sidore Series bring provocative, well-known leaders and scholars to the campus throughout the year. The Blue and White Series is host to leading concert artists, and the Allied Arts Series provides a varied program of drama, music, and dance. Student film societies sponsor film series; and University students perform frequently in concerts and recitals, and tour throughout New Hampshire and neighboring states with the best productions of their theatrical and musical organizations.

The University Library has music listening rooms and a collection of more than 5,500 tapes and records. There is also a student-operated AM-FM radio station on the campus.
General Information

Admissions Procedure

The admissions policy of the University is designed to provide for the admission of those students whose personal record, achievement, aptitude, and motivation demonstrate that they have the qualifications for carrying the desired program satisfactorily. Factors of race, religion, color, and national origin do not enter into the admissions process.

The University admits in-state residents who have a scholastic record ranking them in the upper two-fifths of their graduating classes from accredited or approved secondary schools, provided they are recommended or certified and have an appropriate college preparatory background.

The number of out-of-state students admitted each year is limited and selection is made primarily on the basis of superior academic achievement in secondary school. Such traits as good character, leadership, initiative, and creative ability are considered. In selecting students from out of state, the University attempts to maintain an equal number of men and women. Under the present Selective Admissions Program, applicants are admitted to one of the five undergraduate schools or colleges with the understanding that they have chosen to pursue this area of study. The student should realize that it may not be possible to transfer to another undergraduate division of the University after enrollment. The student who wishes to change to another undergraduate division after enrollment must secure permission from the dean of that college and chairman of the program he wishes to enter. Standards for admission to the different undergraduate areas may vary. Admission to the College of Liberal Arts has been more competitive than to the other four colleges. Because of the larger number of qualified female applicants, admission for this group has been slightly more selective.

Except for Early Decision candidates, applications should be submitted only after the first marking period grades are available and for non-resident applicants before February 15. No New Hampshire applicant can be considered whose application is not complete by March 1. Thereafter, he may be considered only as vacancies occur. A non-refundable application fee, $10 for residents of New Hampshire and $20 for non-residents, must accompany the application.

All students who present the secondary course requirements outlined in the “Minimum Secondary Program” are eligible to receive consideration for admission. The University encourages students to develop a balance between courses outlined in “Recommended Secondary Program” and their own interests, which may lead them to choose electives outside the traditional academic course areas.
Admissions Procedure

Minimum Secondary Program

<table>
<thead>
<tr>
<th>Life Sciences &amp; Agriculture</th>
<th>Liberal Arts</th>
<th>Technology</th>
<th>Whittemore</th>
<th>Health Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>4 units</td>
<td>4 units</td>
<td>4 units</td>
<td>4 units</td>
</tr>
<tr>
<td>Language</td>
<td>0 units</td>
<td>2 units*</td>
<td>0 units</td>
<td>2 units*</td>
</tr>
<tr>
<td>Mathematics</td>
<td>2 units</td>
<td>2 units</td>
<td>3 units†</td>
<td>2 units</td>
</tr>
<tr>
<td>Laboratory Sciences‡</td>
<td>1 unit</td>
<td>1 unit</td>
<td>2 units</td>
<td></td>
</tr>
<tr>
<td>Social Studies</td>
<td>2 units</td>
<td>2 units</td>
<td>2 units</td>
<td>2 units</td>
</tr>
</tbody>
</table>

Recommended Secondary Program

<table>
<thead>
<tr>
<th>Life Sciences &amp; Agriculture</th>
<th>Liberal Arts</th>
<th>Technology</th>
<th>Whittemore</th>
<th>Health Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>4 units</td>
<td>4 units</td>
<td>4 units</td>
<td>4 units</td>
</tr>
<tr>
<td>Language</td>
<td>2 units*</td>
<td>3 units*</td>
<td>3 units*</td>
<td>3 units*</td>
</tr>
<tr>
<td>Mathematics</td>
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</tr>
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<td>Social Studies</td>
<td>3 units</td>
<td>3 units</td>
<td>2 units</td>
<td>3 units</td>
</tr>
</tbody>
</table>

* of a single foreign language.
† college preparatory, math including trigonometry.
‡ excluding "General Science".
‖ must include Physics or Chemistry.
§ should include Biology.

Interviews are not required as part of the admission process. Group information sessions are frequently held on Saturday mornings. These group sessions are opportunities for an exchange of information and are followed by guided tours of the campus. Applicants may contact the Admissions Office for further information. Students are encouraged to visit the campus, and regularly scheduled tours leave the Memorial Union at 2:00 p.m. Saturday and Sunday when the University is in session. Please note Calendar, page 3. All candidates for admission to the University are required to submit the results of the College Entrance Examination Board Scholastic Aptitude Test. The English Composition Achievement Test taken during the senior year must also be submitted by all candidates. For those students applying to Bachelor of Arts degree programs, an Achievement Test in a foreign language is also required. The achievement test results are used in course placement rather than in the admissions evaluation, so it is possible for students to submit these results as late as May of their senior year. Other achievement tests are strongly recommended for applicants in the College of Life Sciences and Agriculture and the College of Technology in the area or areas generally related to the student’s prospective major, e.g. Level I Mathematics Test for engineering students.

Candidates applying for the Arts Major, studio option; the Bachelor of Fine Arts program; or the Art Education program are required to submit a portfolio. There is no portfolio requirement for those entering the Art History option of the arts major. Candidates applying for
the Music, Music Education, and Bachelor of Music programs must make arrangements with the Chairman of the Music Department for an audition. Chairmen of both the Art and Music Departments may be reached at the Paul Creative Arts Center.

Early Decision

The University is willing to give secondary school seniors consideration for admission under an Early Decision program. This program is appropriate for a well qualified student who has made the University his first choice. Applicants must submit a regular application, high school record, junior year Scholastic Aptitude Test, and a statement countersigned by the secondary school that indicates the University of New Hampshire is his first-choice college and that other applications will be withdrawn if he is admitted under Early Decision. Early Decision applications must be submitted between September 15 and December 1. Early Decisions are reported within two weeks of the University’s receipt of Early Decision applications.

Advanced Standing

The University will recognize unusual secondary school work by means of advanced placement and credit for those who have taken enriched or accelerated courses before entering college. Applicants qualify for such credit by satisfactory achievement on University-approved placement examinations including the College Board Advanced Placement Tests. Applicants who have not been enrolled in formal education during the past two years may also qualify for advanced standing through the College Level Examination Program. Further information may be obtained from the Admissions Office.

Transfer Students

The University will consider qualified transfer candidates from approved institutions. Transfer credit is awarded for courses which have been completed with a grade above the lowest passing grade, provided those courses are comparable to courses offered at the University of New Hampshire.

While the University is pleased to encourage the competent transfer applicant who has valid and legitimate reasons for desiring transfer to the University of New Hampshire, it cannot encourage the applicant with a history of academic or personal difficulty. University admissions policy restricts consideration for transfer to those students with satisfactory academic and personal records. In the event of personal or academic difficulty, a student is usually better advised to return to his former college after an appropriate period and clear his record before attempting to transfer. Students desiring to transfer for
the fall semester must complete application procedures before May 1; for semester II, by December 1.

New England Regional Student Program

The University participates in the New England Regional Student Program of the New England Board of Higher Education in which each state university in New England offers a number of regional curricula at the undergraduate level to students from other New England states. Under this program a student receives preferential admissions consideration and, if admitted, pays in-state tuition. Information may be obtained from the New England Board of Higher Education, 40 Grove St., Wellesley, Mass. 02181.

Rules Governing Residence

A student is classified as a resident or a non-resident for tuition purposes at the time of admission to the University. The decision, made by the Director of Admissions, is based upon information furnished by the student's application and any other relevant information.

All applicants living in New Hampshire are required to submit a notarized statement to the effect that their parents are legally domiciled in the state. Students admitted from states other than New Hampshire or from foreign countries are considered as non-resident throughout their entire attendance at the University unless their parents have gained bona fide residence in New Hampshire. A student, though he may be 21, will not be recognized as a resident by the University unless he can clearly establish that his parents, as stated above, are bona fide residents of New Hampshire; the date such a residence was established; and such other information as may be required by the University. The burden of proof in all cases is upon the applicant. If the student maintains his residency apart from that of his parents, he must clearly establish that his residence in New Hampshire is for some purpose other than the temporary one of obtaining an education at the University. Members of the Armed Forces and their dependents are normally granted in-state tuition rates during the period when they are on active duty within the state of New Hampshire.

Subject to the provisions of the preceding paragraph, the residence of an unmarried minor follows that of the parents or legally appointed guardian. The bona fide year-round residence of the father, if living, otherwise that of the mother, is the residence of such a minor; but if the father and the mother have separate places of residence, the minor takes the residence of the parent with whom he lives or to whom he has been assigned by the court order. If neither of the parents is living, the unmarried minor takes the residence of his legally appointed guardian.
Subject to the provisions of the second paragraph above, an adult student (defined for purposes of these rules as one who is either married or 21 years of age or older) will be classified as a resident of New Hampshire if his or her parents are residents of New Hampshire and the student has not acquired residence in another state.

The residence of a wife follows that of her husband; however, a woman student who already has a resident status by reason of the residence of her parents, or by reason of her own residence where she is at least 21 years old, may continue as a resident student although she marries a non-resident.

The following procedure should be adhered to in petitioning for a change in residence status: Submit a notarized letter requesting a change of residence to the Director of Admissions. If the decision of the Director of Admissions is considered incorrect, the student may appeal to an Appeals Committee which has been established by the Board of Trustees. (The decision of this Committee must be considered final.)

In the event the Director of Admissions possesses facts or information indicating a student’s change of status from resident to non-resident, the student shall be informed in writing of the change of status. The student may appeal the decision of the Director of Admissions as set forth in the preceding paragraph.

No application will be considered for changes after September 1 for the fall semester and January 14 for the spring semester. All changes approved during a semester will be effective the beginning of the next semester; none are retroactive.

In all cases, the University reserves the right to make the final decision as to resident status for tuition purposes.

Dining Services

University policy requires that freshmen, sophomores, and juniors who choose to live in residence halls, excluding sorority and fraternity members who eat in their houses, must board in University dining halls.

The University reserves the right to adjust charges when necessary. Changes will be announced as far in advance as possible (see “Fees and Expenses”).

Several meal plans are available. Students designate the plan of their choice when making application for their rooms.

Students who have special diets will generally find it possible to select these diets from the choices offered in the dining halls. However, students whose diets, because of religion or health, require unusual foods should be aware that Dining Services may not always be able to
University Residences

meet their needs. Any request for exceptions to the board policy because of strict dietary restrictions must be made prior to the beginning of a semester.

Tickets are not transferable. Rebates cannot be made for meals missed. The only exception is that rebates are made to students who have been away from campus for prolonged periods due to illness. Such illness must be substantiated by a letter from the student’s doctor. (See “Fees and Expenses”).

Seniors, graduate students, and full time students who do not live in residence halls may purchase any of the meal-ticket plans if dining hall capacities permit.

Seniors, graduate students, and commuting students may also purchase meals at the Memorial Union Food Service on an à la carte basis.

University Residences

The University has 23 undergraduate residence halls with room rents ranging from $440 to $730 and averaging $550 per academic year.

Although students are not required to reside on campus, the University will provide housing, when available, in a University residence hall to all freshman students who follow established application procedures. Undergraduate men and women will be accommodated to the extent of space available.

Assignments to University residence halls are normally completed in August and the notice of room assignment forwarded to the student immediately. Most rooms are designed for double occupancy; however, a limited number of single rooms is available. Frequently, it is necessary to assign three students to some double rooms in a few residence halls.

Students care for their own rooms and are responsible for any damages. Students assigned to residence hall rooms are required to sign a room contract for the entire academic year beginning in September and ending in June. Room rental charges do not include the several school vacation periods when the halls are closed. Rooms paid for and not occupied one day after registration day will be declared vacant and three-fourths of the room rent returned, unless the individual having the reservation makes written request to the Residence to hold the room.

General housing information and applications for room and board will be sent to new students approximately June 15. In the case of upperclassmen, applications will be available prior to room draw in the spring for the residences for the next academic year. Additional information is available through the Residence Office, 7 Stoke Hall.
Financial Aid

The University Financial Aid Office assists promising students who are unable to meet their educational expenses entirely from their own family resources. Aid is available in the form of grants and scholarships, loans, and part-time employment.

In many communities, scholarships and loans are available locally. School principals and guidance counselors have information about these sources of assistance.

Before an applicant may be considered for assistance through the University, two forms must be submitted: the UNH Application for Financial Aid and the Parents' Confidential Statement. New Hampshire applicants may obtain these forms from their high school. Non-residents and transfer students may obtain the UNH application form from the Financial Aid Office and the Parents’ Confidential Statement from their local high schools. Upperclass applicants may obtain both forms from the Financial Aid office.

Students must meet the following deadlines and should not wait until being admitted to the University before applying for financial aid:

Incoming Freshmen—January 15  
Transfer students—May 1  
Upperclass students—February 15  
Readmitted students—May 1

Grants and Scholarships

A full-time student who is a resident of New Hampshire may be considered for an in-state tuition grant. The amount varies from $100 to full tuition, and the basic consideration is financial need. Non-residents are eligible for similar grants. Scholastic attainment, financial need, and participation in extra-curricular activities are the principal considerations.

The University participates in the federally sponsored Educational Opportunity Grant Program designed to assist students of exceptional need.

There are scholarships for both resident and non-resident students. The basis of these awards may be scholastic attainment, participation in extra-curricular activities, or meeting other requirements specified by the donor.

Loan Programs

Three loan funds are administered by the University: UNH Loan Fund, National Direct, and Nursing Student Loans. Financial need must be clearly demonstrated, and loans may be used only for educational expenses.
Many states now have higher education loan plans established by the Higher Education Act of 1965. For information it is suggested that you contact your local bank.

Part-Time Employment

The University does not encourage freshmen or transfer students to work during their first semester, but they may do so if they feel they can carry the extra load. The College Work-Study Program assists students from low income families and other students who are determined by the University to be in need of financial assistance to complete their college educations.

Students who do not qualify for the College Work-Study Program often can find part-time employment on or near campus.

Fees and Expenses

The cost for the freshman year at the University averages about $2,685 for a resident of New Hampshire and about $3,885 for a non-resident.

All University tuition bills, including those for room and board in University buildings, are due and payable on or before registration day of each semester.

Tuition is $950 ($2,150 for non-residents) per academic year. As part of the regional cooperation program of the New England Board of Higher Education, some non-residents from certain states will be eligible at the resident rate in selected curricula. The student must indicate on his application for admission his intention to apply for this reduced tuition. Any undergraduate student registering for nine credits or more per semester pays the full tuition.

Any combination of courses taken at the University (Durham Campus), Merrimack Valley Branch, and Division of Continuing Education totaling nine credits or more requires full tuition payment. Any student registering separately at the University (Durham Campus), Merrimack Valley Branch, and Division of Continuing Education and who pays the per-credit-hour charge at the University (Durham Campus) or Merrimack Valley Branch or the course charge at the Division of Continuing Education will be subsequently billed, if any combination totals nine credits or more, an additional amount necessary to meet the full tuition charge.

Students are permitted to enroll for more than 20 credits only with the approval of their College dean. After 30 days of the semester have passed students carrying more than 20 credits will be billed a per-credit
fee of $30 for each credit above 20. (No refund will be made if the student subsequently drops a course bringing him to 20 or less credits.) Any undergraduate student registering for fewer than nine credits pays $30 per credit hour, plus a registration fee of $15 for residents and $50 for non-residents per semester. The minimum charge for any recorded course is $30.

All students who are admitted to the University must make an advance deposit of $50 for residents and $100 for non-residents. This deposit will be credited on the student’s tuition bill. In case a student decides not to attend the University after making his deposit, it will automatically be forfeited.

Three-fourths of tuition and room charges will be refunded to a student withdrawing within one week of registration; one-half after one week and within thirty days; and none thereafter. (See University Calendar, page 5.) A $10 fee must be paid by all students dropping courses after the first two weeks of classes. The $10 fee will not be charged to students filing petitions for reduced loads or students withdrawing; and in both of these cases, the regular tuition rebate policy will apply. There are no refunds of the fees which are charged.

Generally there will be no meal-ticket refund except for illness, but a student who withdraws is entitled to a prorated rebate based upon meals remaining from withdrawal-date less two weeks.

Refundable deposits may be required to cover locker keys or loss or breakage in certain departments. A charge will be made for individual lessons in music, as noted in the description of Applied Music courses. A charge will be made for riding lessons, as noted in the sections on Physical Education and Animal Science and for field trips of the Thompson School.

Books and classroom supplies cost approximately $150. These may be purchased at the University Bookstore.

There is a Memorial Union fee of $25; a recreation/physical education fee of $30; a student service fee of $10; and a student activity tax of $18.30 (1972-73) which includes a subscription to the undergraduate newspaper and yearbook, and membership in Student Union, Student Government, and class activities. These fees cover the academic year. An optional student season-athletic ticket is available for $15 and optional student insurance for $23.75.

Housing charges average $550 per academic year.

Personal expenses average $350. These will vary with the needs of the individual student, and include clothing, laundry, recreation, incidentals, and travel.

The University reserves the right to adjust charges for such items as tuition, board, and room rent from time to time. Such changes will be announced as far in advance as feasible.

All University bills, including those for room and board in Uni-
versity buildings, are due and payable in full on or before registration day for each semester.

Parents and students who wish to make periodic payments should consult their local banks or other financial institutions which provide programs for budgeting educational expenses.

### Fees and Expenses

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<th>Non-resident</th>
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### Reserve Officers Training Corps Programs

The Army and Air Force offer programs leading to a commission as a second lieutenant in their respective services. Students enrolled in either ROTC program may pursue any University curriculum which leads to a baccalaureate or higher degree. The Army program is open to men only. The Air Force program accepts both men and women.

Two- and four-year programs are available. The four-year program is open to freshmen and to transfer students who began ROTC at another institution. In addition to on-campus ROTC course requirements, students must attend an officer preparatory training session for a part of one summer.

Two-year ROTC programs are open to students who have two academic years of study remaining at the University. Applicants for the two-year programs must attend a six-week training session during the summer immediately preceding their entry into ROTC.

ROTC scholarships are offered on a competitive basis by both the Army and the Air Force. Entering freshmen may compete for four-year scholarships during the last year of high school. Students, who are enrolled in a four-year ROTC program, and two-year-program applicants compete for scholarships covering their remaining academic years. Scholarships pay full tuition, all mandatory University fees, and required
General Information

textbooks for all courses. In addition, all scholarship recipients receive a tax-free $100 per month subsistence allowance. Non-scholarship students in the last two years of an ROTC program also receive the tax-free $100-per-month subsistence allowance.

Students in either Army or Air Force ROTC who are qualified for pilot training are provided civilian flight instruction leading to a private pilot’s license.

More specific information about ROTC programs may be obtained by contacting the Professor of Military Science (Army ROTC) or the Professor of Aerospace Studies (Air Force ROTC).
University Academic Requirements

A student is held responsible for all work required for graduation and for the scheduling of all the necessary courses.

In addition to the particular requirements established by the colleges for specific degrees, the University requires that every candidate for a bachelor's degree must successfully obtain a passing grade in a minimum of 128 credits; must attain a cumulative grade-point average of at least 2.0 for all courses taken at the University in which a grade is given; and must successfully meet the following general education requirements:

1. Four courses (each of which must carry at least three credits) from among the following (biological sciences, physical sciences, and mathematics):

   Biological Sciences
   Animal Science 400
   Biochemistry
   Biology
   Botany
   Entomology
   Microbiology
   Plant Science 421, 706, 708, 762, 769, 773

   Soil and Water Science 501 and 504
   Zoology

   Physical Sciences and Mathematics
   Chemistry
   Earth Science
   Mathematics
   Physical Science
   Physics

2. Six courses (each of which must carry at least three credits) from the following (arts, humanities, and social sciences):

   Arts and Humanities
   Arts
   English
   Foreign Languages (except elem. yr.)
   and Literature
   Humanities
   Liberal Arts
   Music
   Philosophy
   Speech & Drama

   Social Sciences
   Anthropology
   Economics
   Education 481 and 657
   Geography (except physical geography)
   History
   Political Science
   Psychology
   Recreation and Parks 400
   Resource Economics (except 501 & 504)
   Sociology
   Social Science
University Academic Requirements

3. Six courses, one of which must be freshman English unless specifically exempted by the English Department, and each of which must carry at least three credits, from all courses offered by the University including those listed above.

The University, College, or Department may prescribe up to eight of the sixteen courses used to satisfy the general education requirements. A minimum of eight courses are to be freely elected by the student. Courses taken to satisfy general education requirements may not be in the student’s major department.

A University freshman English course in reading and composition is required of all undergraduates unless specifically exempted by the English Department on the basis of a combined score of 1200 or better on the CEEB SAT-Verbal, and English Achievement exams. The freshman English course may not be used to satisfy the arts and humanities requirement in general education.

Grades and Honors

Grades: an instructor may assign grades as listed below. The intermediate grades are designated by adding plus to the letter grade. Grade points assigned to plus grades are 0.5 higher than those assigned to the letter grade without the plus.

A (Excellent): academic achievement of outstanding quality.
B+: intermediate grade.
B (Good): academic achievement of high quality.
C+: intermediate grade.
C (Acceptable): academic achievement of a quality acceptable in satisfying the minimum requirements for graduation.
D+: intermediate grade.
D (Unsatisfactory): academic performance below the minimum level established as a prerequisite for graduation, but not so deficient as to demand repetition of the courses, unless such repetition is essential for demonstration of competence in the major field.
F (Failure): academic performance so deficient in quality as to be unacceptable for academic credit.
Cr. (Credit): given in specific courses designated as No Letter Grade; also assigned spring semester, 1969-70.
P: a passing grade in a course taken under the Pass-Fail option.
Grade reports designate incomplete course work with the notation “IC.” “IA” indicates incomplete in a continuing course or thesis. “IX” indicates grade not reported.
Grade points per semester hour shall be assigned as follows: A, 4; B+, 3.5; B, 3; C+, 2.5; C, 2; D+, 1.5; D, 1; F, 0; Cr., 0; P, 0.

Honors: A student will be listed for honors if he has a cumulative and semester average of at least 3.0 regardless of the number of grad-
able credits; or a semester average of 3.0 with twelve or more hours of courses carried for letter grades. These categories will be used: 3.0 to 3.4, Honors; 3.5 and 3.6, High Honors; 3.7 to 4.0, Highest Honors. Seniors who have earned honors for their entire college work will be graduated with the honors earned.

**Pass-Fail:** While earning a bachelor's degree the pass-fail option for grading may be carried in a maximum of four courses outside the courses required by the major department upon election by the undergraduate student. The status of the student is to be known prior to the end of the fifth week of the semester. The course will not be included in the grade point calculation, but the Pass or Fail will be recorded, and in the case of a "Pass" the course credits will be counted toward degree requirements. The Pass-Fail option may not be available for courses taken for a minor. Consult the appropriate College for information.

Students may not use the Pass-Fail option to repeat a course.

**Minimum Graduation Average**

A cumulative grade point average of 2.0 is the minimum acceptable level for undergraduate work in the University, and for graduation from the University. The Academic Standards Committee examines the records of students periodically, and may place academically deficient or potentially deficient students on warning, or may exclude, suspend, or dismiss those who are academically deficient.

**Quota of Semester Credits**

Any student registering for less than 12 or more than 20 credits must receive the approval of his college dean.

An undergraduate is assigned class standing on the basis of semester credit hours of academic work completed with a passing grade, as follows: to be a sophomore—26 credit hours; to be a junior—58 credit hours; to be a senior—90 credit hours.

**Withdrawal from the University**

Students who leave the University after Registration Day are expected to file formal withdrawal notification with the Registrar.

**Residence**

Students who are candidates for a bachelor's degree must attain the last one quarter of total credits for the degree in residence unless granted permission by the Academic Standards Committee to transfer part of this work from other accredited institutions.
University Academic Requirements

Two Degree Option

General Policy: The option to pursue two degrees simultaneously enhances and broadens the education of certain students at the undergraduate level. The program is only for those students who can adequately handle the requirements for two different degrees and who can reasonably allocate the additional time and effort needed for the program.

Requirements:
1. If the student is planning to take one degree in a highly prescribed curriculum, he should register as a freshman in the appropriate school or college for that curriculum.
2. It is expected that a candidate for two degrees will complete the equivalent of five years of academic work.
3. The two degrees, as awarded by the University of New Hampshire, must be different (i.e., B.A. and B.S., or B.S. and B.S.F., etc.).

Supervision: As soon as a student is accepted as a candidate for two degrees, the appropriate dean(s) will appoint supervisors for each of the proposed majors. The supervisors and the student will work out a basic course plan for the two degrees and inform the appropriate dual-major dean(s) of the plan. The supervisors will maintain joint control over the student's academic program. The college offices and the supervisors will receive copies of grade reports and other records for students pursuing two degrees.
College of Liberal Arts

Allan Spitz, Dean
Melville Nielson, Associate Dean
James A. Smith, Associate Dean
Nancy H. Deane, Assistant Dean
Agnes G. Hohmann, Academic Counselor
Claire W. Wright, Academic Counselor

Divisions and Departments

BIOLOGICAL SCIENCE DIVISION
Microbiology Department
Zoology Department

HUMANITIES DIVISION
The Arts Department
English Department
French and Italian Department
German and Russian Department
Music Department
Philosophy Department
Spanish and Classics Department
Speech and Drama Department

SOCIAL SCIENCE DIVISION
Geography Department
History Department
Political Science Department
Psychology Department
Sociology and Anthropology Department

TEACHER EDUCATION DIVISION
Education Department
Programs of Study

BACHELOR OF ARTS:
Anthropology
The Arts
   Studio
   Art History
Biology Teaching
Classics
English
English Teaching
French
Geography
German
Greek
History
Humanities
Latin
Microbiology
Music
   Music History
   Performance Study
   Music Theory
Philosophy
Political Science
Psychology
Social Service
Sociology
Spanish
Speech and Drama
   Communications
   Theater
   Communication Disorders
Zoology

BACHELOR OF SCIENCE:
Art Education
Music Education

BACHELOR OF FINE ARTS

BACHELOR OF MUSIC:
Piano
Organ
Voice
Strings, Woodwind, Brass, or Percussion
Theory
General Information

Purpose and Objectives

It is the purpose of the College of Liberal Arts, as a center of learning and scholarship, to help all of its members achieve an understanding of the heritage of civilization and to educate them in the tradition of the past and the realities of the present so that they may recognize and act upon their obligations to the future.

The College endeavors to meet the educational needs of each student through the development of interests and skills which, combined with the student's potential, makes possible the living of a richer and more useful life.

Programs of Study

The College of Liberal Arts offers four degrees: Bachelor of Arts, Bachelor of Science, Bachelor of Fine Arts, and Bachelor of Music.

The Bachelor of Arts program is intended primarily to provide a broad liberal education along with a major in one of the fields listed above. Requirements for the Bachelor of Arts degree and information regarding these majors are presented in the section entitled Bachelor of Arts Program.

The Bachelor of Science curricula consist of two programs of study which provide preparation for teaching of the Arts or Music. They are arranged in such a manner as to permit considerable specialization while providing a broad cultural education for the students enrolled in them. Requirements for the Bachelor of Science degree and information regarding these curricula are presented in the section entitled Bachelor of Science Curricula.

The Bachelor of Fine Arts Curriculum is designed to provide training for the student who plans to enter professional graduate school. Requirements for the Bachelor of Fine Arts curriculum are outlined in the section entitled Bachelor of Fine Arts Curriculum.

The Bachelor of Music curriculum is designed to provide professional training in applied music and in musical theory, and to allow students to develop their talent to the equivalent standard of that offered by conservatories of music. Requirements for the Bachelor of Music curriculum and information regarding this curriculum are presented in the section entitled Bachelor of Music Curriculum.

NOTE: Although the University will try to provide sufficient facilities so that a student may pursue any major or curriculum for which the student meets the requirements, such a privilege cannot be guaranteed. Rapidly increasing enrollment sometimes results in the crowding of required specialized courses beyond capacity. On occasion, a student
may remain in a crowded curriculum if willing to take certain courses during the summer session.

Combined Programs of Study

In addition to pursuing a single major, a student may combine programs of study as follows:

MINOR OPTION

A student may earn a minor in any undergraduate discipline in the University in which permission to do so can be arranged by the student in consultation with the major adviser and the minor supervisor. A minor consists of 20 semester hours with C or better in subjects that the minor department approves. (Courses taken on the Pass-Fail basis may not be used for a minor.) No more than 8 credits used by the student to satisfy requirements in a major may be used for the minor. A student should declare an intent to earn a minor as early as possible and no later than the end of the junior year. During the final term an application should be made to the Dean to have the minor shown on the transcript.

DUAL MAJOR OPTION

A student may earn two majors in any disciplines in the University which award the Bachelor of Arts degree if authorized by the major departments and the college dean(s). No more than 8 credits used to satisfy requirements for one major may be used for the other. A student should declare an intent to earn two majors as early as possible and no later than the end of the junior year. A student should plan the program in consultation with advisers from both majors.

DUAL DEGREE PROGRAM

The purpose of the two-degree program is to broaden the education of certain students at the undergraduate level. The program is only for those students who can adequately handle the requirements for two different degrees and who can reasonably allocate the additional time and effort needed for the dual program. See page 24 for requirements.

STUDENT DESIGNED MAJOR

See page 125 for requirements for student designed major.

Preparing for Teaching

The University offers two undergraduate programs for teacher education—one for secondary-school teacher preparation and one for elementary-school teacher preparation. These programs are being reorganized into a five-year teacher education sequence. Please consult the Department of Education for further information.

These programs have limited capacity and are selective. Admission to the University does not guarantee admission to the program even though other selection criteria are met.
For information regarding the elementary and secondary Master of Arts in Teaching program, see the Graduate Catalog.

Secondary School Teacher Preparation Program

All students preparing to teach in secondary schools follow a basic professional secondary-school teacher preparation program. Education 481 and 657 are taken before the student-teaching block semester. The block semester contains four courses: Education 658, Education 659, Education 694, and 691, special methods of teaching course, offered by the student’s major department. The block semester is normally taken during one semester of the senior year, the semester being determined by the student’s major field of study.

A student is admitted to the student teaching block semester upon approval of the Department of Education and of the major department. A cumulative grade point average of 2.2 or better and a major subject grade point average of 2.5 or better are required for admission to the block semester. Application for admission to the student-teaching block semester is made through the Coordinator of Secondary Student Teaching during the week of February 14, the semester preceding the academic year during which student teaching will be done.

Secondary-school teacher preparation programs in art, music, men’s physical education, women’s physical education, and home economics vary slightly from the basic pattern described above. A student preparing to teach one of these subjects should consult early with the major adviser in planning a teacher-preparation program and with the Coordinator of Secondary Student Teaching. The earlier this consultation occurs, the greater the opportunity for the student to design the most appropriate major for teaching.

A student in the secondary-school teacher preparation program does not major in the Department of Education but in a subject-matter department. A student interested in the program should consult with the major-subject adviser and with the Coordinator of Secondary Student Teaching.

Elementary School Teacher Education Program

Students planning to teach in elementary schools will declare elementary education as their major and will get suggestions for prerequisites from the Elementary Education program personnel. Information about this major is presented in the section entitled Bachelor of Arts Program.

Elective Courses in Education

Two courses in education are designed to be of interest to the general student as well as to the prospective teacher. Courses in Educational Psychology (Education 481) and Psychology of Human Learning (Education 657) are substantive rather than procedural and thus
are appropriate for any student who wishes to have a better understanding of the process of education.

**Student Teaching**

Students in both the elementary-school teacher preparation program and the secondary-school teacher preparation program student-teach in public schools in the vicinity of the University. Student teachers work with cooperating teachers selected jointly by public school administrators and members of the University faculty. Each student teacher is supervised by a cooperating teacher and a member of the Department of Education. Each student teacher in the secondary-school teacher preparation program is also supervised by a University professor or a resident supervisor. Students in the elementary-education program may be placed in teams of two, if desirable, in order to encourage interaction.

Each student teacher ultimately assumes full teaching responsibility for one or more of the cooperating teacher’s classes after a period of observation, planning, and service as a teacher aide.

**Accreditation and Certification**

The teacher preparation programs of the University are accredited by the National Council for the Accreditation of Teacher Education, for the preparation of elementary teachers, secondary teachers, and school service personnel, with the master’s degree as the highest degree approved.

Completion of the approved teacher preparation program of the University qualifies a student for certification as a teacher in most states. There are a few which have unusual requirements for certification. The Chairman of the Department of Education will be glad to advise students regarding requirements.

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**Bachelor of Arts Program**

The Bachelor of Arts Program provides a broad liberal education with a concentration involving a minimum of 32 credits in a major field.

**Degree Requirements**

Satisfaction of these requirements ensures satisfaction of the University general education requirements.

These requirements apply to all students who enter the College of Liberal Arts between July 1, 1973 and June 30, 1974 and are seeking a Bachelor of Arts degree. (Students who entered the College at an earlier time may apply for a change to the requirements of this catalog.)
1. 128 credits.

2. At least a 2.0 cumulative average in all courses completed at the University of New Hampshire.

3. Four courses in sciences and/or mathematics outside the major department, from those offered in biochemistry; biology; botany; chemistry; entomology; earth science; mathematics; microbiology; physics; zoology; Animal Science 400; Plant Science 421, 706, 708, 762, 769, 773; and Soil and Water Science 501 and 504.

4. Two courses in humanities, selected from those offered in arts, English (beyond 401), foreign languages (beyond 401-402), humanities, liberal arts, music, philosophy, and speech and drama, outside the major department.

5. Two courses in social sciences from those offered in anthropology, economics, Education 481 and/or 657, geography (excluding physical geography), history, political science, psychology, Recreation and Parks 400, resource economics (excluding 501 and 504), sociology, and social science, outside the major department.

6. Two additional humanities or social sciences courses, outside the major department.

7. Six additional courses, not in a student's major department, selected from all courses offered by the University. English 401 must be taken in the freshman year as one of these courses, unless the student is exempted. Students exempted from English 401 must substitute a course not in the major department, to make up a total of six courses in this category.

8. Foreign Language Requirement: Proficiency in a foreign language at the level achieved by satisfactory work in a one-year college level course is required of all students. This requirement may be fulfilled by achieving a score of 500 or better on a College Board foreign language achievement test, or by completing a full-year elementary course in any foreign language, or by completing a semester of a course in foreign languages numbered 501 or above, if eligible. This requirement must be satisfied by the end of the sophomore year.

9. Major Requirements: A student must complete at least 32 credits of major course work with grades of C or better. The major department may specify certain (but not more than 13) required courses which constitute a major, and may require a senior paper or project, and/or a comprehensive examination. (In majors where courses in the Secondary School Teacher Preparation program are required, these courses are not counted in the maximum of 13 allowed.) These requirements are given in the listing of majors that follows. A major must be selected prior to the beginning of the junior year.
Majors in the Bachelor of Arts Program

The objectives, opportunities, and department requirements of majors in the Bachelor of Arts program are described in the paragraphs which follow.

Anthropology

This major aims at providing an introduction to the various branches of anthropology and an appreciation of its place among the other academic disciplines. At the same time it is designed to encourage intensive study of particular topics within the field according to the interests and talents of the student. It is intended to provide both a broad basis for the education of the general student, and to offer sufficient background for those who may wish to pursue a career in anthropology at the graduate level.

Students majoring in anthropology are required to take a minimum of 32 credits with grades of C or better distributed as follows: Anthropology 411 and 412, one topical course, one ethnographic-area course, Reading and Research in Anthropology, and any three other courses in anthropology or related disciplines as approved by the supervisor. In addition, a senior essay involving independent work in the library or field will be required of each student. Anthropology courses are listed separately under “Sociology and Anthropology” in the Course Descriptions.

Students wishing to major in anthropology should consult with Professor Richard E. Downs.

The Arts

The courses offered by the Department of The Arts provide an opportunity, within the Liberal Arts framework, for serious art students to acquire a thorough knowledge of the basic means of visual expression or to acquaint themselves with the history of art. In addition, these courses are designed to offer foundation experience for students interested in art, but who are majoring in other departments in the University. The Department of The Arts offers programs leading to a Bachelor of Fine Arts degree, a Bachelor of Science degree, and a Bachelor of Arts degree.

The Arts major leading to a Bachelor of Arts degree is offered with two options: studio and art history. Students selecting the studio option
must complete with a grade of C or better a minimum of 11 courses (44 credits), of which the following are required: Arts 431, Visual Studies; Arts 432, Drawing I; Arts 434, Introduction to Three Dimensional Design; Arts 475 and 476, Introduction to The Arts; two elected art history courses; two elected studio courses; and one upper-level studio course or advanced seminar.

While the above represent the minimum departmental requirements for the studio option, students may wish to plan a program involving greater depth in one or several of the studio areas in the department, i.e., ceramics, metal and jewelry, painting, drawing, graphic arts, photography, sculpture, weaving, and wood.

Students selecting the studio option are required to complete four foundation courses (Arts 431, 432, 434, and 475 or 476) during their first year. Candidates applying for the Arts major, studio option; the Bachelor of Fine Arts program; or the Art Education program are required to submit a portfolio. There is no portfolio requirement for those entering the art history option of the Arts major.

Non majors must complete one of the foundation courses (Arts 431, 432, 434) before they are allowed to enroll in any 500-level studio courses.

The University reserves the right to retain a selection from a student's work for a period of not more than two years.

Students selecting the art history option must complete with a grade of C or better a minimum of nine courses (36 credits) of which the following are required: Arts 475 and 476, Introduction to The Arts; Arts 797, Seminar in Art History; four additional courses in art history; and two basic studio courses chosen from among Arts 431, Visual Studies; Arts 432, Drawing I; and Arts 434, Introduction to Three Dimensional Design. A major adviser in the area of the student's interest will be selected.

Biology Teaching

The biology teaching major is intended for students planning to teach in secondary schools. Completion of the biology teaching major will generally not qualify students for admission to graduate schools, either to pursue graduate work in biology or in any of its sub-disciplines. Students interested in pursuing various aspects of academic biology will find suitable majors in the College of Liberal Arts, and in the College of Life Sciences and Agriculture.

Because few secondary school positions are available in any year for teaching biology alone, a student should include courses in the program of study which will provide the qualifications for teaching other sciences.
The minimum course requirements are as follows: Chemistry 403-404; Biochemistry 501 or Chemistry 545; Physics 401 or 406; Botany 411; Botany 503; Zoology 412, 507-508; Biology 541; plus three other courses in the biological sciences to be decided in consultation with the adviser. Students must also complete all courses in the Secondary School Teacher Preparation Program. At least 32 credits of biological science courses must be completed with a grade of C or better.

Students interested in majoring in biology teaching are advised to request supervision through the Department of Zoology office.

Classics

The Classics major is offered by the Classics section of the Department of Spanish and Classics. The minimum requirements for a major in Classics are as follows: 40 credits offered by the Classics section, excluding Latin 401-402. Twenty-four of these must be in courses in Greek and Latin. The student will be encouraged to take courses in related fields such as ancient history, classical art, modern languages, and English.

The Department also offers an honors program in Classics. Participation in this program entails completion of the major requirements plus a senior research project and paper.

The supervisor for majors is the Chairman of the Department, Professor John C. Rouman.

Elementary Education

Students planning to teach in elementary schools major in the Department of Education as elementary-education majors. This major is unique, combining strong liberal arts preparation with a full year of professional study. For the first three years the student follows the Bachelor of Arts program. Also recommended for elementary-education majors is either Education 481 and/or Home Economics 525, or Psychology 575 (no additional education courses should be taken before entrance into the elementary-education block). In addition, it is recommended that elementary-education majors take three courses (12 credits) in mathematics in the special 600 series. Elementary education majors must complete 20 credits in a minor subject.

Students should demonstrate a personality suitable for teaching, gain experience working with groups of children, and have a cumulative grade point average of at least 2.5. The entire senior year is
English

The Department of English offers two programs of study: the English major and the English-teaching major.

The English major has two chief objectives: to provide all students with a common core of literary experience and to provide each student with the opportunity of shaping a course of study to suit individual interests. The flexibility and freedom inherent in the second of these objectives places a responsibility upon the student to devise a program which has an intelligent rationale. For example, the student who intends to pursue graduate study in English literature should choose more than the minimum number of advanced literature courses, and should seek a broad historical background. Students with special interests in linguistics or writing may, on the other hand, wish to elect only the minimum number of advanced literature courses required for the major. The student interested more specifically in journalism should note the descriptions of courses in non-fiction writing. All students should secure the assistance and approval of their advisers in formulating an early plan for their major program. For full details see the booklet entitled The English Major, available at the departmental office, Hamilton Smith 113.

For the English major, students must complete ten English courses with a grade of C or better: English 519, two additional 500-level courses, and seven courses numbered above 600. In selecting these courses, students must be sure to meet the following distribution requirements:

1. Two courses in literature prior to 1800: either two advanced courses (numbered above 600), or one advanced course and English 513.
2. Two courses in literature since 1800: either two advanced courses, or one advanced course and one course from the following list: English 514, English 515, English 516.

Students who intend to teach English in a secondary school should enroll in the English-teaching major. For this major, students must meet the state certification requirements for teaching (Education 481, 657, 658, 694, and English 791, 792. For requirements in education courses, see section entitled Preparing for Teaching.) They must also pass the following courses with an average of 2.5 or better: English 512, 514, 705 or 706, 709, 710, 711, 757, and two additional literature
courses numbered above 700. English 513 may be substituted for the second 700-level course. Students may enroll for a semester of practicum for English-teaching majors.

Students who are interested in majoring in English should consult with the Chairman, Professor Robert Hapgood.

French

The Department of French and Italian offers at the present time a major in French only. The supervisor for majors is the departmental chairman.

A major consists of a minimum of 36 credits. French 401-402, 501, 503-504, 505-506, and 514 do not count toward a major. French 605-606 and 790 are required of majors. The student will be encouraged to take courses in related fields, such as English, history, philosophy, music, and art.

A minor in French consists of 20 credits in French courses numbered 501 and above.

The Department also offers a junior year abroad at the University of Dijon. This program is open to all qualified students at the University of New Hampshire. See Description of Courses, French 685-686.

Geography

Geography is best defined as the discipline that describes and analyzes the variable character, from place to place, of the earth as the home of man. As such, geography is an integrating discipline, studying many aspects of man’s physical and cultural environment that are significant to understanding the character of areas or the spatial organization of the world.

Because its integrating character establishes common areas of interest with many other fields of knowledge, geography is an excellent core discipline for a liberal education. Thus, students who have a primary interest in the spatial organization or the regional character of the world and who also desire a liberal education can attain these goals by majoring in geography. Those wishing to prepare for careers as professional geographers are advised to concentrate their course work in geography and closely related fields, and should plan to go on to graduate study after completing an undergraduate major in geography.

Students who major in geography are required to take Geography 401, 402, and seven additional courses in geography or related fields.
approved by their supervisor to a total of 28 semester credits with grades of C or better. The seven courses should include Geography 571, 572; 581, 582; 797; and two additional intermediate level courses in geography.

A minor in Geography consists of five courses (20 credits) in Geography with grades of C or better.

Students who are interested in majoring in Geography should consult with the supervisor, Professor William H. Wallace.

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German

The Department of German and Russian offers a major in German only. This program is designed to be of interest to the following groups of students:

1. Those who have a special interest in the German language, literature, and culture.

2. Those who intend to enter professions in which a background in foreign languages and literatures is desirable. Examples of such professions are library science, international banking, trade, science, and government services.

3. Those who plan to teach the German language in secondary schools. Since most secondary schools require their teachers to teach more than one subject, students planning to enter teaching at this level must plan their programs carefully. They should combine a major in one of the languages and its literature with a minor or at least a meaningful sequence of courses in another subject.

4. Those who intend to go on to graduate study in the field of Germanic linguistics and literature. Such graduate study is requisite to teaching at the college level and to other specialized work in the field.

The department offers a junior year abroad at the University of Salzburg. This program is open to all qualified students at the University of New Hampshire. See description of courses, German 685-686.

A major must comprise a minimum of 32 credits in German language and literature. German 401-402 does not fulfill part of the requirements for a major. All students are required to take the Graduate Record Examination in German. German 605-606 and German 781 are required courses for all majors.
Greek

The Greek major is offered by the Classics section of the Department of Spanish and Classics. The supervisor for majors is the Chairman of the Department, Professor John C. Rouman.

The minimum requirements for a major in Greek are as follows: 32 credits in Greek, including Greek 401-402. The student will be encouraged to take courses in related fields such as Latin, Classics, and ancient history.

The Department also offers an honors program in Classics. Participation in this program entails completion of the major requirements plus a senior research project and paper.

History

Students majoring in history must complete 32 credits in history with grades of C or better. These courses should include a minimum of two semester courses each from two of the first three Groups. (See the description of courses offered by the department); and at least four semester courses of the total should be courses numbered 600 or above. In addition every senior student majoring in history is required to complete with the grade of C or better the course, History 697, Colloquia for Senior History Majors. This course is in the nature of an undergraduate seminar, and will treat broad topics or problems of American, European, and Non-Western history. The specific subject of the course will change from semester to semester. History majors should register with the Department for a particular section of this course at some time shortly before the beginning of their senior year.

Students intending to major in history should consult with the Chairman of the Department, Professor Douglas L. Wheeler.

Humanities

The major in humanities allows a student to design and pursue under faculty guidance a coherent interdisciplinary program in the humanities (art, drama, language, literature, music, philosophy). The student defines the subject and selects a program of related courses. The subject may be a historical period or any other topic which can be explored through several disciplines in the humanities. The program must have clear educational and intellectual merit, and prepare
the student to undertake a senior project of at least four credits on his subject (Humanities 699). The program must be sponsored by a faculty member from the Humanities Division and approved by the Humanities Steering Committee.

A student who wishes to become a Humanities major should submit a formal proposal to the Steering Committee by the end of the sophomore year. Normally, the student should have a grade-point average of at least 2.7. The student should select most of the courses for the program from those offered for major credit by departments within the Humanities Division, but the student is encouraged to include courses from outside the Division (especially from History) when they are appropriate to the major subject. The number of courses in the program may vary, but at least 32 credits of major course work must be completed with grades of C or better.

Before submitting formal proposals, interested students are urged to seek the advice of Steering Committee members and other faculty in the Humanities Division. Inquiries about the Humanities major should be directed to: Anthony Caldwell, coordinator of the Humanities major, Department of English.

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**Latin**

The Latin major is offered by the Classics section of the Department of Spanish and Classics. The supervisor for majors is the Chairman of the Department, Professor John C. Rouman.

The minimum requirements for a major in Latin are as follows: 32 credits in Latin, excluding Latin 401-402. The student will be encouraged to take courses in related fields such as Greek, Classics, and ancient history.

The Department also offers an honors program in Classics. Participation in this program entails completion of the major requirements plus a senior research project and paper.

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**Microbiology**

Students interested in the study of microorganisms, including the bacteria, rickettsiae, and viruses, should register as majors in microbiology. Such students may prepare themselves for a career in city, state, or federal government service, or a position with universities, research institutes, or industrial organizations. Opportunities are avail-
able in the areas of general microbiology; medical, public-health, or veterinary microbiology; environmental microbiology; and marine microbiology.

Students who major in microbiology are expected to complete courses offered by the department, and by related departments, to a total of 32 semester credits, with grades of C or better. A course in organic chemistry is required of microbiology majors. It is strongly recommended that students also take a year's work in mathematics and physics, and a semester of biochemistry. The courses of each major program are selected to meet the needs of the individual student, as determined by the student and the supervisor.

Students interested in majoring in microbiology are advised to consult with Professor William R. Chesbro.

Music

The Department of Music offers three degree programs: the Bachelor of Arts, the Bachelor of Music, and the Bachelor of Science in Music Education. The last two are discussed in separate sections of this catalog.

The Bachelor of Arts program offers the student an opportunity to major in music within the liberal arts curriculum. This program is intended for those who wish to pursue the serious study of music and to acquire at the same time a broad general education; it is recommended for those considering graduate study leading to the M.A. or Ph.D. degrees.

To be formally admitted to the B.A. program, a student must give evidence of satisfactory musical training by taking an admission audition. A student must declare music as a major prior to the beginning of the junior year, but it is highly recommended that the student declare as early as possible considering the large number of required courses. A student's admission to junior standing, the upper level of the degree program, will be subject to review by the Music Department faculty.

The B.A. degree requirements include the satisfactory completion of a Senior Comprehensive Examination covering the fields of music history and theory, and a public performance to be given during the senior year—for music-history majors this must be a lecture or lecture-recital; for performance majors, a full recital; for theory majors, a lecture, lecture-recital, or a recital including at least one original composition. A more detailed description of these degree requirements is included in the Undergraduate Student Requirements Handbook of the Department of Music.
The Bachelor of Arts degree is offered with three options: Music History, Performance Study, and Music Theory. All students majoring in Music must complete with the grade of "C" or better a minimum of 32 credits of course work in music, of which the following are required: Music 471-472, 571-572, and 501-502. In addition, the specific requirements for each option are given below.

**OPTION I.** Music History: advanced theory (4 credits); advanced history and literature (12 credits); any one of 541-550 inclusive (8 credits). A student must also demonstrate the ability to sight-read a Bach chorale harmonization.

**OPTION II.** Performance Study: advanced theory or literature (4 credits); performance study (16 credits—two credits per semester). Qualified students may major in voice, piano, strings, woodwinds, brass, or percussion. Voice majors must successfully complete, in addition to the foreign language requirement, one of the following course sequences: Italian 401-402, German 401-402, French 401-402.

**OPTION III.** Music Theory: advanced theory (12 credits); advanced history (4 credits); any one of 541-550 inclusive (8 credits). A student must also demonstrate the ability to sight-read a Bach chorale harmonization. The emphasis in this option is on musical composition and/or theory.

All students minoring in music must complete with the grade of "C" or better a minimum of 20 credits of course work in music, of which the following are required: Music 471-472, Music 501-502.

The Department of Music is a member of the National Association of Schools of Music. Prospective B.A. majors in music are advised to consult with Professor Donald Steele.

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**Philosophy**

400-level courses acquaint the beginning student with some of the fundamental concerns of philosophy and introduce him to philosophical thinking. These courses aim particularly, although not exclusively, to give a self-contained experience of philosophy to the student who plans to take only a single course.

Philosophy 570 (Ancient Philosophy) and Philosophy 580 (Modern Philosophy) are, along with Philosophy 415 (Explanation), the core of a philosophy major. These courses provide that foundation in the history of philosophy which is prerequisite to serious philosophic thought. Students who are considering a philosophy major, or who are conscious of a more-than-ordinary interest, should register for these courses as early as possible, since they are prerequisite to most of the advanced courses.
500-level courses other than 570 and 580 provide opportunities for philosophic exploration of such special fields as art, politics, education, religion, psychology, semaitcs, ethics, and logic. Since they presuppose no prior courses in philosophy, they are ideally fitted to the student who wishes to gain a philosophic perspective upon the field of his major. Philosophy 600 (Philosophy through Literature) and Philosophy 630 (Philosophy of Science) have the same purpose on a more advanced level, still without presupposing prior courses in philosophy.

Philosophy 650, 670, 680, 699, 795 are for majors and others who have achieved advanced standing in philosophy.

Any student who wishes to major in philosophy must choose (or be assigned) an adviser who will help work out a major program. Normally, a student must have three semesters left as an undergraduate and have completed the core (Philosophy 570, Ancient Philosophy; Philosophy 580, Modern Philosophy; and Philosophy 415, Explanation) to be a major.

The rest of the philosophy student's major will consist of at least five additional courses above the 400 level; of these, three must be on the 600 or 700 level. Usually all eight courses will be taken in the Department of Philosophy but when it will serve the student's special interests, courses outside the department may be taken, subject to departmental review.

A student who does superior work in Philosophy and writes (with department approval) a superior Senior Thesis will receive a Letter of Commendation.

Students interested in majoring in philosophy should consult with the Administrative Officer for the Department.

Political Science

The study of politics, to which the courses and seminars of the Political Science Department are devoted, includes the development of knowledge of political behavior by individuals and groups, as well as knowledge about governments: their nature and functions, their problems and behavior, and their interactions—at the national and international levels and at the local, state, and regional levels.

Much of the learning offered by the Political Science Department can also be regarded as essential for good citizenship, since political knowledge helps to explain both the formal institutions by which societies are governed and the issues which encourage people toward political interest and political action. In addition, such learning is especially valuable to students planning to enter local or national gov-
ernment or other public service, including the foreign service, and will be of great help to those who intend to study law and enter the legal profession. For teaching, particularly at the college level, and for many types of government service, graduate work may be indispensable; and an undergraduate major in Political Science will provide the most helpful foundation for later graduate study in the field. Such an emphasis will also be valuable for those students seeking careers in journalism, international organizations, and the public affairs and administrative aspects of labor, financial, and business organizations.

The major in Political Science consists of a program chosen to develop an understanding, beyond the introductory level, of at least three of the five fields in which the Department’s courses are offered: Political Thought; Scope and Methods of Political Science; American Politics; Comparative Politics; and International Politics.

The total program for a major will consist of no less than 36 credits and no more than 48 credits in Political Science. Each student is responsible for completing the following requirements: 1. the introductory courses Political Science 401 and 402. (Students who successfully complete the departmental examination on American Institutions may substitute Political Science 531 for Political Science 402.); 2. the core course at the 500 level in at least three fields. All courses in the major program beyond the 400 level must be passed with grades of "C" or better.

Introductory courses, numbered 400, are designed for freshmen and should be taken before the end of the sophomore year. Courses at the 500 level are the basic or core courses in each field and are prerequisite for further work in those fields by majors; except by permission of instructor (and successful completion of an examination in the case of 531), they are not open to freshmen. Intermediate courses, numbered 600, are open after successful completion of the respective core course. They are not open to freshmen. Courses at the 700 level are specialized and advanced, and are designed for seniors, and juniors of advanced status; they are not open to freshmen or sophomores. Seminars, numbered 790-799, are open only to seniors, and are designed to encourage individual research, exploration, and small group discussion with faculty.

Majors planning to pursue graduate work should make arrangements to take the Graduate Record Examination early in their senior year. Students planning to apply for law school should plan to take the Law School Admission Test early in the senior year; information is available from the office of the Department Chairman. Students who are preparing to teach government courses in secondary schools should coordinate their programs with the Department of Education, and majors in political science should also be aware of dual major options outside the Department. Majors interested in direct practical experience in
public affairs during their undergraduate study may enroll in Social Science 681 and work as an intern in a public agency, with the approval of the Department Chairman and the Director of the Public Administration Service, affiliated with the Department. Departmental colloquia and other special programs involving public-affairs work are sponsored from time to time.

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**Psychology**

A general function of the Department of Psychology is to provide an academic major that will contribute to the broad education of the undergraduate student. Specifically, the student will be exposed to the scientific study of behavior and will achieve an increased understanding of the behavior of humans and animals.

Students majoring in psychology are required to complete 32 credits in courses which meet the following criteria. Each course that is to be counted toward fulfilling major or minor requirements must be passed with a C or better. Specific requirements for majors are: 1. Psychology 401; 2. Psychology 601; 3. Five courses, selected from among the following options: Psychology 602, 751, 752, 753, 758, 778, and 794; 4. One additional psychology course, chosen from the following options: Psychology 545, 575, 589, 789, 795, or any course not chosen from among those listed to fulfill requirement 3 above.

In the cases of students whose educational goals would best be served by variations in Requirements 3 and 4 above, such variations may be worked out between the student and the student's major adviser. Such variations must be approved by the adviser and a statement of the reasons filed in the student's record.

Any psychology major planning to go on to graduate work should include Psychology 602 among the courses selected.

Students wishing to minor in psychology must register with the department during their junior year. Psychology minors must complete 20 credits in courses offered by the department that count for a major.

Students declaring psychology as a major may state their preference for a specific adviser and such preferences will be met where possible. Students expressing no preference will be assigned an adviser. Psychology majors may change advisers with the consent of the adviser to whom they are changing.
Social Service

A major in Social Service has as its primary purpose the preparation of baccalaureate graduates for social work practice. Its additional purposes are to contribute to the liberal education of students and to prepare students for admission to graduate schools of social work or for graduate professional education in one of the other human-service professions.

Social Service majors will be concerned with specialized subject matter dealing with the origin, development, and organization of health and welfare institutions. The social work profession and its relationship to social problems also will be emphasized. To enable each major to acquire an understanding of social work/social welfare through observation and participation, the major is required to affiliate in a social-welfare setting for a number of weeks as part of undergraduate study. This may be done the summer preceding the senior year. The details of the field placement will be arranged between the student and the faculty adviser.

Social service majors are required to take: Sociology 400 or Anthropology 411; Psychology 401; any two courses from Sociology 500, 530, 540 or Psychology 545; Sociology 520 or Home Economics 683; Sociology 601, 522, 622, 631 and 703. At least 32 credits of this work must be completed with grades of "C" or better in each course.

Students wishing to major in Social Service should consult with Professor Pauline Soukaris at the Social Science Center.

Sociology

The major in sociology is: for students who desire a liberal education with emphasis on study of the organization and differentiation of society, including study of the research methods developed in recent years for a better understanding of social phenomena; and for students who intend to do graduate work in sociology, or for students who plan to attend a graduate school of social work but prefer a choice of undergraduate electives different from that permitted the social service major.

Students who wish to teach sociology in secondary schools are advised that such teachers usually have to teach related social studies. Students with this vocational aim should consult with the chairman of the Department of Education.

It is recommended that majors in sociology take Sociology 400 during their freshman or sophomore years. They must complete a min-
imum of 36 semester credits with grades of C or higher in sociology. Sociology 400, 601, 602, 611, 612 are required. At least two of the additional major courses must be at the 600 or 700 level (not including 795 or 796 or the project). During the senior year majors must either pass a written comprehensive examination or complete a research project.

Students who are interested in choosing sociology as a major should consult with the chairman of the Departmental Committee for Undergraduate Studies. It is the responsibility of each student majoring in sociology to obtain the latest information from the department office.

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Spanish

The major in Spanish is for those students who wish to acquaint themselves more thoroughly with the language, culture, and literature of the Spanish-speaking peoples.

In addition, through the major, the student can achieve practical goals: teaching Spanish in the grade or high schools, or teaching other subjects in bilingual programs. Following advanced degrees, teaching at the college level and engaging in scholarly research, or entering such fields as linguistics or library science are career opportunities. Majors gifted in languages consider the fields of translation and interpretation. With course work in business, sociology, psychology, speech, etc., the Spanish major is uniquely suited to work in Spanish-speaking areas of the world as well as bilingual regions of the United States and also with many governmental agencies.

The Department sponsors a Junior Year in Spain program, which offers students further opportunity to gain practical experience in the use of the Spanish language. The program is open to non-majors as well (see the course description for Spanish 685-686 for further information).

The minimum requirements for a major in Spanish are as follows: 32 credits in Spanish, excluding Spanish 401-402. The Department also offers an honors program in Spanish. Participation in this program entails completion of the regular major requirements plus a senior research project or paper.

Students intending to major in Spanish should consult with the Assistant Chairman for Spanish, Professor F. William Forbes.
Speech and Drama

The Department of Speech and Drama offers a major with three options: communications, theater, and communication disorders.

The major option in communications emphasizes a broad integrative approach to the theories and practices of verbal and non-verbal communication. Interdepartmental course work, reasonable course substitution on an individual basis, proficiency exemption, and field or laboratory work are encouraged to meet individual communications needs or goals. Communications course work can be readily related to social sciences, humanities, etc., and provides a pre-professional preparation for vocations such as law, public relations, personnel work, mass communications, cinema, etc.

The major option in theater stresses a broad background in the arts within their social framework. The student interested in the creative aspects of speech communication will find an opportunity for personal and pre-professional growth in theater and its drama, with opportunity for independent study of basic theories and personal involvement in active laboratory situations. Theater as a composite art, reflecting life, is closely related to painting, sculpture, music, dance, literature, and philosophy. As a public event, theater can be viewed through social science perspectives. Some of the fields of interest to graduates are children's theater and creative dramatics; public recreation, television, cinema; acting, direction, and design on all levels of theater; and teaching.

The major option in communications disorders provides a study of normal speech and hearing processes contrasted with basic courses in the pathologies of communication and their treatment. It emphasizes a broad, liberal education as essential preparation for successful study of communications disorders on a graduate level. A study of human utterance involves, psychology and sociology, as well as basic linguistics, anatomy, physics, etc., providing an integration of many traditional academic disciplines. The certification of the American Speech and Hearing Association requires a master's degree or its equivalent.

 Majors in the communications option shall elect ten courses (40 hours) distributed as follows: 1. Four courses in communications studies; 2. Two courses in rhetoric and public address; 3. Four courses in an area of emphasis in communications, e.g. communication studies, rhetoric and public address, mass media. A student and adviser must agree upon the courses used to establish an area of emphasis before student enrolls in such courses. All courses must be directly related to the building of competence in the area of emphasis. Courses not offered in the option, but offered as regular courses in the University, may be used to establish an area of emphasis in communication.
The required curriculum for majors in the theater option consists of: Communications I (402); Theater and Its Drama I (435); either Theater and Its Drama II (436) or Theater and Its Drama III (438); Rehearsal and Performance I (551), Rehearsal and Performance II (552), Rehearsal and Performance III (657), Scenic Arts I (459); Scenic Arts IV (652); one full course or its equivalent from Performance Project (654) and Scenic Arts Project (655)—both may be repeated; Senior Seminar I (697), Senior Seminar II (698).

The required curriculum for majors in the communications disorders option consists of: Communications I (402); Applied Phonetics of American English (524); Speech and Hearing Science (521); Speech Pathology I (631); Speech Pathology II (632); Basic Audiology (704); Clinical Practice in Speech Pathology (634); Special Problems in Communication Disorders (602) to the extent of 4 credits (one full course).

Students interested in majoring in the Department of Speech and Drama should consult with the chairman.

Zoology

The zoology major is designed to prepare students for admission to graduate work, at least two years of which is considered minimal for undertaking professional work in pure or applied zoology. Other students may elect the major, but there will be no reduction in requirements.

The University's location on tidewater and near the open ocean provides an unusual opportunity for study of marine zoology and marine ecology.

Zoology majors must earn grades of C or better in 32 credits of biology (botany, biology, zoology) courses. Minimum requirements for the zoology major are as follows: Chemistry 403-404; organic chemistry; calculus (Mathematics 427) or statistics; college physics; Botany 411; Biology 541; Zoology 412, 518, 527, 604, 729, plus an elective.

Students who are interested in a zoology major should consult the supervisor, Professor Emery F. Swan.

Bachelor of Science Curricula

The Bachelor of Science curricula permit considerable specialization in preparation for teaching of the Arts or Music while developing the breadth and general culture of the students enrolled in them. Curricula are offered in: art education and music education.
Art Education

Degree Requirements

These requirements apply to students who enter the College of Liberal Arts between July 1, 1973, and June 30, 1974, and who are seeking a Bachelor of Science degree.

1. 128 semester-hour credits.
2. At least a 2.0 grade-point average in all courses completed at the University of New Hampshire.
3. All the University General Education Requirements including English 401.
4. Specific Curricula Requirements: These are presented in the detailed listing of the curricula. Note that the curricula have special quality requirements. Courses are to be completed generally in the sequence in which they are arranged.

Art Education Curriculum

This curriculum is designed to prepare teachers and supervisors of art in the public schools. Courses are prescribed to provide a sound background in studio and educational practices and to allow enough flexibility so that a student can develop a high degree of competency in a particular studio area. The satisfactory completion of the curriculum will satisfy the initial certification requirements for teachers of art in the public schools of New Hampshire and in most other states.

A cumulative grade-point average of 2.2; a grade-point average of 2.5 in all art courses; and a grade-point average of 2.5 in all education courses, including Art Education 792, are required to be eligible for Education-Art 694, Supervised Practice Teaching.

Students seeking to transfer to the University of New Hampshire from other accredited colleges must arrange an appointment with the supervisor of the curriculum or the department chairman prior to admission to the curriculum.

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<th>FRESHMAN YEAR</th>
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<tr>
<td>Arts 431</td>
<td>Visual Studies</td>
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<td>Arts 432</td>
<td>Drawing I</td>
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<td>Arts 434</td>
<td>Introduction to 3-D Design</td>
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<td>English 401 or Elective</td>
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<td>Science</td>
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<td>Social Science or Humanities</td>
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### College of Liberal Arts

**SOPHOMORE YEAR**
- Arts 475, 476: Introduction to The Arts 4 4
- Elective 4
- Arts 541: Drawing II 4
- Arts 542: Beginning Oil Painting 4
- Science 4
- Social Science or Humanities 4
- Art Education 493: Introduction to Art Education 4

**JUNIOR YEAR**
- Arts 401: Ceramics 4
- Art Education 452: Contemporary Media 4
- Education 481: Educational Psychology of Development 4
- Art Elective 4
- Science 4
- Arts 536: Graphic Arts 4
- Social Science or Humanities 4
- Education 657: Psychology of Human Learning 4

**SENIOR YEAR**
- Art Education 792: Problems of Teaching Art in Elementary Schools 4
- Arts 544: Water Media 4
- Electives (2) 8
- Education 658: Principles of Teaching 4
- Education 659: Principles of Education 4
- Art Education 694: Supervised Teaching of Art 6
- Art Education 791: Problems of Teaching Art in Secondary Schools 4

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### Music Education Curriculum

The Bachelor of Science degree program in Music Education is designed to prepare students for careers in public school music at both the elementary and secondary levels. This program is based on the demand for teachers possessing sound musicianship and a broad cultural background in addition to specialized preparation in music education. It is fully accredited by the N.H. State Department of Education and complies with standards set for certification of teachers of music in most states. The Department is affiliated with the Music Educators National Conference and is a member of the National Association of Schools of Music.

To be formally admitted to the B.S. program in Music Education, a student must give evidence of a sound musical background by satisfactory performance at an admission audition. Proficiency on the piano is strongly recommended but not required.

A student must declare music education as a major prior to the beginning of the junior year, but it is highly recommended that students declare as early as possible considering the large number of required courses. All music education majors must choose a major instru-
ment or choose to be a voice major before the end of their first semester at the University.

A student's admission to junior standing, the upper level of the degree program, will be subject to review by the Music Department faculty. This review will be based on the student's academic work and progress in performance study. Music education majors must pass a piano proficiency examination before they may be admitted to full junior standing. Students who fail to achieve junior standing may be excluded from upper-level courses in the Music Department, or may be required to take an extra semester of preparation.

The B.S. degree requirements in music education include the satisfactory completion of a Senior Comprehensive Examination covering the fields of music education, music history, and music theory, and a public performance to be given while in residence at the University during the senior year (the minimum senior recital is a half-recital).

A cumulative grade-point average of 2.2, a grade-point average of 2.5 in all music courses, and a grade-point average of 2.5 in all education courses including Music Education 787 are required to be eligible for the student teaching block (see Senior Year, Semester II below).

To complete degree requirements in four years, the student is allowed very little flexibility in choice of courses. The candidate might well consider spending more than eight semesters to complete the curriculum, gaining a broad general education background while preparing for the professional degree. This may be accomplished by electing the student teaching block as the ninth semester, or by spreading course work over nine semesters and placing the student teaching block in the tenth semester. Prospective B.S. majors in music education are advised to consult with Professor Cleveland Howard, adviser to freshman and sophomore music education majors.

Course Requirements:


3. Performance Study: 13 semester credits (8 semester credits must be in the student's major instrument or voice) and Music 551-552 (formerly Music 575-576).

4. Music Laboratory: Music Education majors should be members of a major performing group (Concert Choir, Chamber Chorus, The Newhampshiremen, University Symphony, or University Band) each semester in residence.

5. Techniques and Methods: the B.S. degree in Music Education is offered with three tracks. The differences in these tracks lie exclusively in the required techniques and methods courses. A student's choice of
track and selection of these techniques courses should be done in consultation with his music education adviser. The following are the minimum requirements:

**Track I—Instrumental:** Music Education 545, 546, or 745 (instrumental majors are strongly advised to take 545 or 546 during the freshman year), and Music Education 747, 749, 751.

**Track II—Vocal/Choral:** Music Education 540, 741-742, 743.

**Track III—Combined Instrumental and Vocal/Choral:** all of Track I, Music Education 540, 741.

6. **Music Education:** Music Education 787, 791.

7. **Education:** Education 481, 657, 658, 659, 694. (All courses in one of the three tracks, Music Education 787, Education 481 and 657 must be completed prior to Education 694, which must be taken in the senior year).

8. **University general education requirements:** courses to complete graduation requirements (see University Academic Requirements).

The following is a suggested four-year program of studies:

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<th>FRESHMAN YEAR</th>
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<tr>
<td>General Education Requirement</td>
<td>4</td>
<td>6 or 8</td>
</tr>
<tr>
<td>Music 571</td>
<td>4</td>
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<tr>
<td>Music 572</td>
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<tr>
<td>Music 501</td>
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<td></td>
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<tr>
<td>Music 502</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Performance Study</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Music Laboratory</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Music Techniques and Methods</td>
<td>2</td>
<td>2</td>
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<tr>
<td></td>
<td>18</td>
<td>18 or 20</td>
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</tbody>
</table>

52
Bachelor of Fine Arts

JUNIOR YEAR
Education 481 4
General Education Requirement 8
Music 551 2
Music 552 2
Music 779 4
Performance Study 2 2
Music Laboratory 1 1
Music Techniques and Methods 4 4

SENIOR YEAR
General Education Requirement 4
Non-music elective 4
Education 657 4
Music Education 787 2
Performance Study 1
Music Laboratory 1

Student Teaching Block:
Education 658 4
Education 659 4
Education 694 (Music) 6
Music Education 791 4

17 17
16 18

Bachelor of Fine Arts Curriculum

The Bachelor of Fine Arts curriculum is designed to provide training for the student who plans to enter professional graduate school. The program consists of 16 courses fulfilling the university academic program requirements and from 14 to 16 courses in the Department of The Arts. The courses in the Department of The Arts comprise a basic program of seven courses to be completed in the freshman and sophomore years, with an additional seven to nine advanced courses in the arts to be completed during the junior and senior years.

The basic program consists of two courses in drawing, one course in two-dimensional design, one course in three-dimensional design, two introductory courses in art history and one introductory studio course. This basic unit of seven courses is designed to provide a common body of concepts and techniques for all students enrolled in the program and is intended to raise the level of creative achievement in the advanced stages of the program.

During the junior and senior years the student will concentrate on four courses in either the two-dimensional or three-dimensional disciplines in the Department of The Arts. The two-dimensional disciplines of the Department of The Arts are Drawing, Painting, Graphic Arts, Photography, and Weaving. The three-dimensional disciplines are Sculpture, Ceramics, Jewelry and Metalsmithing, and Woodworking. The division of the advanced program into two-dimensional and three-dimensional areas is designed to provide the student with strong
conceptual resources in a concentrated area of creative activity without limiting him to a single discipline. The advanced student will also be required to take one elective course in art history, one course in color theory and practice, and two elective courses which may be in the Department of The Arts or in other departments of the University. These courses should be coordinated with the program of the individual student. Finally, the senior student will be required to take a seminar which may concentrate in one of the disciplines of the department or be of a cross-disciplinary nature.

Bachelor of Music Curriculum

The Bachelor of Music degree program is offered to students who wish to develop their talent in performance or composition to a high professional level. The program is recommended to those considering graduate study leading to the M.M. or D.M.A. degrees. Prospective B.M. majors are advised to consult with Professor Donald Steele.

To be formally admitted to the B.M. program, a student must demonstrate significant creative ability or a high degree of competence in a performance medium during an admission audition or examination. The student must declare the B.M. as a degree program prior to the beginning of the sophomore year.

A student’s admission to junior standing, the upper level of the degree program, will be subject to review by the Music Department faculty. Admission to junior standing will be based in part on the student’s knowledge of music theory and music history, and may involve a special performance before the music faculty. Failure to achieve junior standing may result in the student’s exclusion from the Bachelor of Music program.

The B.M. degree requirements include the satisfactory completion of a Senior Comprehensive Examination covering the fields of music history and theory, and a public performance to be given during the senior year (for performance majors this must be a full recital; for theory majors, a lecture, lecture-recital, or a recital including at least one original composition). A more detailed description of these degree requirements is included in the Undergraduate Student Requirements Handbook of the Department of Music.

The Bachelor of Music curriculum offers concentration in the following areas:

Option 1. Piano.
Option 2. Organ.
Option 3. Voice.
Option 4. Strings, woodwinds, brass, or percussion.

Option 5. Theory (Composition).

Requirements for the degree include: 128 semester credits; a minimum 2.0 grade-point average in all courses completed at the University of New Hampshire; selected general education requirements as listed in the following options: specific curriculum requirements as follows. Courses are to be completed generally in the sequence in which they are arranged.

FRESHMAN YEAR

All Options:  
English 401, Freshman English 4  
General Education Requirement  
   selected science 4 4  
   selected social science 4  
Music 471-472, Theory I 4 4  
Option 1. Music 542, Piano (8 credits).  
Option 2. Music 544, Organ (8 credits).  
Option 3. Music 541, Voice (8 credits); Music 542, Piano (2 credits); Music Laboratory—Choral, (2 credits).  
Option 4. Performance Study—major instrument, (8 credits); Music 542, Piano (2 credits); Music Laboratory—instrumental, (2 credits).  
Option 5. Music 542, Piano (2 credits); Performance Study—brass, (1 credit); Performance Study—woodwind, (1 credit).

SOPHOMORE YEAR

All Options:  
General Education Requirements  
   selected social science 4 4  
   selected humanities 4 4  
Music 571-572, Theory II 4 4  
Option 1. Music 542, Piano (8 credits).  
Option 2. Music 544, Organ (8 credits).  
Option 3. Music 541, Voice (8 credits); Music 542, Piano (2 credits); Music Laboratory—choral, (2 credits).  
Option 4. Performance Study—major instrument, (8 credits); Music 542, Piano (2 credits); Music Laboratory—instrumental, (2 credits).  
Option 5. Music 542, Piano (2 credits); Music 501-502, Music History (8 credits); Performance Study—strings, (1 credit).

JUNIOR YEAR

All Options:  
Elective (Foreign language recommended) 4 4  
Option 1. Music 542, Piano (8 credits); Music 501-502, Music History (8 credits); Music 771-772, Counterpoint (4 credits); Music 455 (455), Piano Ensemble (2 credits).  
Option 2. Music 544, Organ (8 credits); Music 501-502, Music History (8 credits); Music 771-772, Counterpoint (4 credits); Music 465, Voice Class for Beginners (2 credits); Music Education 741, Techniques and Methods in Choral Music (2 credits).  
Option 3. Music 541, Voice (8 credits); Music 542, Piano (2 credits); Music 501-502, Music History (8 credits); a second foreign language—German,
College of Liberal Arts

French or Italian (8 credits); Music Laboratory—choral and/or opera workshop, (4 credits).

Option 4. Performance Study—major instrument, (8 credits); Music 501-502, Music History (8 credits); Music 551-552, Conducting (4 credits); Ensemble, (2 credits); Music Laboratory—instrumental, (2 credits).

Option 5. Music 771-772, Counterpoint (4 credits); Music 775-776, Composition (4 credits); Music 779, Orchestration (4 credits); Music 781, Form and Analysis (4 credits); Music 542, Piano (2 credits).

SENIOR YEAR

Option 1. Music 542, Piano (8 credits); Music 455 (455), Piano Ensemble (2 credits); Music 735-736, Pianoforte Literature (8 credits); two 4-credit courses elected in advanced theory and literature; two 4-credit courses elected outside the Department of Music.

Option 2. Music 544, Organ (8 credits); two 4-credit courses in liturgical music, organ literature, repertoire and hymnology; two 4-credit courses in music literature and/or advanced theory; two 4-credit courses elected outside the Department of Music.

Option 3. Music 541, Voice (8 credits); Music 542, Piano (2 credits); two 4-credit courses in music literature and/or advanced theory; Music Laboratory—choral, ensemble, and/or opera workshop, (4 credits).

Option 4. Performance Study—major instrument, (8 credits); two 4-credit courses in music literature and/or advanced theory; two 4-credit courses elected outside the Department of Music; Music Laboratory—instrumental, (2 credits); ensemble, (2 credits).

Option 5. Music 773, Canon and Fugue (2 credits); Music 777-778, Advanced Composition (8 credits); Music 542, Piano (2 credits); two 4-credit courses in music literature; two 4-credit courses elected outside the Department of Music.

All students are responsible for adding electives as needed to total a minimum of 128 credits for graduation.
College of Life Sciences and Agriculture

Harry A. Keener, Dean  
Avery E. Rich, Associate Dean  
Emery C. Booska, Assistant to the Dean

Departments and Institute
Animal Sciences  
Biochemistry  
Botany and Plant Pathology  
Entomology  
Home Economics  
Plant Science  
Institute of Natural and Environmental Resources

Degrees, Majors, and Specializations

BACHELOR OF ARTS:
Botany and Plant Pathology  
Entomology

BACHELOR OF SCIENCE:
Animal Sciences  
Animal Science  
Dairy Science  
Poultry Science  
Pre-Veterinary Medicine  
Biochemistry  
Botany and Plant Pathology  
Entomology  
General Studies  
Home Economics  
Family Studies  
Human Nutrition and Dietetics  
Occupational Education  
Plant Science  
Institute of Natural and Environmental Resources  
Agricultural Engineering*  
Community Development  
Environmental Conservation  
Forest Resources (B.S. in Forestry)  
Hydrology  
Resource Economics  
Soil Science  
Wildlife Management

*First two years at the University of New Hampshire, second two years at the University of Maine.
Purpose and Programs
The objectives of the College of Life Sciences and Agriculture are to give the student a fundamental education in the biological, physical, and social sciences and to introduce him to the arts and humanities. In addition, specific technical courses are provided in the student’s interests and in his major.

The College offers three undergraduate degrees: the Bachelor of Arts, the Bachelor of Science, and the Bachelor of Science in Forestry.

Advisory System
A member of the faculty closely related to the student’s area of interest is appointed as an adviser to assist the student in planning his academic program.

The student may select his major upon entering the College or he may wait until registration for the sophomore year.

Two-Degree Option
See page 24 for requirements for two-degree option.

Honors Program
The College of Life Sciences and Agriculture, through its various departments, offers the superior student the opportunity to participate in an honors program which is individually designed to provide added intellectual incentives and opportunities. Participation in the honors program is by invitation of a faculty member with the approval of the Department concerned and the Dean of the College. It is limited to those students entering the sophomore or junior year with at least a 3.0 grade point average. The recommending faculty member, his department Chairman, and the Dean will constitute the student’s academic advisory committee. This committee and the student will decide upon a suitable academic program. Departmental and College course requirements may be waived for students in the program. The student will complete the same number of credits to graduate as other students in the department.

Student Designed Major
See page 125 for requirements for student designed major.

Minor Option
A minor may be earned in any undergraduate program in the University in which permission to do so can be arranged by the student in consultation with his major adviser. A minor consists of 20 semester
Bachelor of Science

credits with C or better in courses which the adviser in the minor program approves. He should declare his intent to earn a minor as early as possible.

In the student’s final semester the adviser for the minor shall certify to the Registrar that the student has completed the minor requirements. Upon graduation the name of the minor shall appear on the student’s transcript.

Bachelor of Arts

Students majoring in Botany and Plant Pathology or Entomology may elect to earn either a Bachelor of Arts degree or a Bachelor of Science degree. See page 30 for general requirements for the Bachelor of Arts degree.

Bachelor of Science

Many professional careers are open for graduates of the College. There are opportunities for people trained in resource development and conservation in addition to positions serving in agricultural industries. Emerging countries throughout the world are asking for assistance in all phases of agriculture, including home economics and forestry. In all departments students may prepare for further graduate work in their respective fields of interest.

Following are additional examples of employment agencies and industries and the careers which they offer.

The agricultural industries, food processors, and banks employ graduates as price analysts and managers.

State planning and recreation agencies, soil conservation services, the cooperative extension services, and private research firms employ rural and urban planners, hydrologists, conservation experts, resource development economists, nurserymen, and landscape gardeners.

The Peace Corps and the Foreign Agriculture Service hire farm production experts, soil and water managers, market analysts, agricultural engineers, teachers, plant and animal breeders, and nutrition specialists.

The federal government and state agencies, universities, health services, and private foundations employ biochemists, geneticists, animal nutrition specialists, plant and animal pathologists and physiologists, veterinarians, foresters, home economists, and entomologists.
Academic Requirements

For the Bachelor of Science degree a total of 128 credits are required. In addition the student must complete the University academic requirements found on page 21, obtain a written recommendation for graduation from his adviser and department chairman, and achieve a 2.0 cumulative average for all courses taken at the University of New Hampshire.

Animal Sciences

The animal sciences courses are offered to provide students fundamental scientific training in such specialized areas as genetics, physiology, nutrition, animal hygiene, processing, pathology, and management. The student also has an opportunity to further concentrate his studies in the fields of animal, dairy, or poultry science; pre-veterinary medicine; or animal biology.

Outstanding graduates are qualified to pursue advanced study in preparation for college teaching, research, and responsible technical positions in industry and federal and state agencies. Students interested in production and processing can receive training as production managers, for positions in the feed or equipment industries, marketing organizations, animal breeding associations, sales and service work in allied industries, and other areas of the diversified animal industry.

The department maintains Morgan horses for all phases of class work including riding. Herds of Shorthorn, Hereford, and Angus cattle; Yorkshire swine; and a flock of Dorset sheep are maintained.

The nationally recognized dairy herd, consisting of registered Ayrshire, Guernsey, Holstein, and Jersey animals, is housed in a new dairy barn. The Ritzman Animal Nutrition Laboratory includes bomb calorimeters, metabolism stalls for digestion studies, respiration chambers for heat production measurements, and other facilities used in nutrition teaching and research with both farm and laboratory animals.

Completed new poultry farm facilities are for instruction and research and include laboratories for both teaching and research in poultry genetics, nutrition, diseases, and management.

Laboratory facilities, including such modern equipment as ultra centrifuge, amino acid analyzer, gas chromatograph, and electron microscope are available in Kendall Hall to provide the latest scientific training in the field of animal hygiene. Kendall Hall is an entirely new facility with five floors devoted to offices, classrooms, and laboratories for the Animal Sciences Department.

The department works closely with the New Hampshire animal industry and frequent class trips are made to leading farms, industrial
Botany and Plant Pathology

concerns, processing plants, etc. where opportunities are presented for viewing industry in action.

Students who contemplate veterinary medicine as a career should confer early with the adviser to preveterinary-medicine students. It should be noted that all veterinary colleges give first preference for admission to applicants from their respective states. Out-of-state students who are admitted must show above average scholastic ability. It is desirable that applicants to colleges of veterinary medicine have some farm experience; and, in fact, it is a prerequisite for admission to some.

Biochemistry

Biochemistry is the study of the chemistry of living things and of life processes. A student majoring in biochemistry will receive a fundamental training in chemistry, including courses in general, analytical, organic, and physical chemistry. An equally broad program in biological sciences is recommended. In addition to training in biochemistry, including an opportunity to participate in basic research during the senior year, students may select courses in botany, zoology, microbiology, genetics, and other biological disciplines.

The curriculum is designed to provide a strong foundation for employment in research and service programs of universities, medical schools and hospitals, research institutes, and industrial or government laboratories.

A degree in Biochemistry will also provide an excellent educational background for professional training in graduate schools and in schools of medicine, dentistry, public health, and pharmacy.

A student who wishes to major in Biochemistry should register for Chemistry 405-406, Mathematics 427-428, Botany 411, and Zoology 412 in the freshman year. Students are advised to consult with Professor Edward J. Herbst, Department Chairman, as early as possible to assure the most effective curricular planning.

Botany and Plant Pathology

The Botany and Plant Pathology program is designed to explore the fundamental nature of plants. Botany graduates with suitable undergraduate backgrounds may enter the field of secondary education or become research technicians. Those students who have an interest in University teaching and/or research, governmental research, and certain
kinds of industrial positions should expect to complete graduate education in the field.

The principal areas of concentration in the Department are: (1) plant physiology, (2) cell biology, (3) ecology, (4) phyeology, (5) biological oceanography, (6) plant pathology, (7) systematic botany, (8) plant anatomy and morphology, and (9) mycology.

Two Botany and Plant Pathology degrees are offered: Bachelor of Science and Bachelor of Arts. All undergraduate Botany majors are asked to take the following core of Botany courses: 411, General Botany (or equivalent); 503, The Plant World; 566, Systematic Botany; 706, Plant Physiology; and 758, Plant Anatomy or 762, Morphology of the Vascular Plants. Beyond that, the program of each individual student is selected by the student and his adviser to meet his particular needs.

Students interested in becoming Botany and Plant Pathology majors are invited to discuss the matter with Professor May Biggs.

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**Entomology**

Entomology offers courses for students who wish to specialize in the study of insect life, insect control, and insects in relation to man. There are opportunities for employment in a number of federal and state agencies, in public institutions, and with commercial and industrial firms. Many opportunities exist in the areas of crop protection, forestry, conservation, and in public health.

Students are given a fundamental training in entomology and related fields. Qualified students planning a professional career in entomology are encouraged to undertake graduate study. Those who wish to specialize in chemical control of insects will be expected to take courses in mathematics and chemistry.

Students who major in entomology are expected to complete successfully courses offered by the department, to a total of 32 semester credits, with grades of C or better. Courses in other departments may be counted with the consent of the major supervisor.

A student may earn either a Bachelor of Science or Bachelor of Arts degree in Entomology.

Those contemplating a career in entomology are advised to consult with the chairman of the Entomology Department.
General Studies

This curriculum is offered for the student who wishes to secure a broad non-specialized background in several areas related to the College without specializing in any particular department. After completing the University general education requirements the student may select courses to fit his specialized or general interests. A student transferring from one major to another may wish to register in the General Studies curriculum until educational objectives have been more clearly defined, or a student may complete the work for the Bachelor of Science degree in the General Studies curriculum provided that the student has a broad interest in the life sciences.

In addition to meeting the University requirements, it is expected that a student would earn at least 32 credits in Life Sciences and Agriculture courses. Courses in closely related fields may be substituted with permission of the adviser. Interested students should consult with the Associate Dean of the College of Life Sciences and Agriculture.

Home Economics

The objectives of the program in home economics are to provide, through the facilities of the University, a broad general education in the social and natural sciences, the humanities, and the arts, and to provide specialized instruction based on these disciplines as preparation for professional careers in which the interests and well-being of the individual, the consumer, and the family are paramount.

The department provides professional preparation through five major programs open to men and women: (1) secondary school education, (2) pre-school education, (3) family services, (4) consumer services, (5) human nutrition and dietetics.

The department has been approved by the New Hampshire State Board of Education, Division of Vocational and Technical Education, for the preparation of nursery, kindergarten, and secondary-school teachers in vocational home-economics and family-life programs. The program in human nutrition and dietetics has been approved by the American Dietetic Association. Requirements of some professional programs make it advisable for the student to specify an option as soon as possible, by the sophomore year at the latest.

A candidate for the degree of Bachelor of Science completes 32 courses or a minimum of 128 credits an average of C or better, distributed as follows: University or general education requirements, 16 courses or 64 credits (see page 21); professional or specialized education
requirements, 16 courses or 64 credits (these must be completed with a grade of C or better). The latter must also include a minimum of nine courses or 36 credits in home economics, three courses or 12 credits in social or natural sciences, and four courses or 16 credits of professional preparation to meet certification standards for secondary school teaching, ADA requirements for a dietetic internship, or other specified objectives.

Institute of Natural and Environmental Resources

Agricultural Engineering

Under this accredited program, a student completes the first two years of course work at the University of New Hampshire, then transfers to the University of Maine for the junior and senior requirements, receiving a Bachelor of Science degree. Inquiries about the program should be addressed to the Associate Dean of the College of Life Sciences and Agriculture.

Community Development

The Community Development Program deals with broad aspects of community problem resolution including economic, social, political, and technical matters. Communities are viewed as systems subject to meaningful analysis. Resolution of community problems requires knowledge and skills of considerable breadth. The curriculum takes an interdisciplinary approach, and includes field experience as a vital component, along with classroom and independent study. Students will conduct independent projects under Resource Economics 795, 796—Investigations in Resource Economics.

While this program is suitable for preparing any citizen for more effective leadership in his community, employment opportunities are available in the United States, Canada, and in emerging nations. Many federal and state agencies are now undertaking community assistance programs and need personnel who are trained to apply the arts and sciences to the problems of communities. Similarly, many private and local groups are concerned with community planning and development.

Students interested in a Community Development major or minor may consult with the program coordinator, Dr. Edmund F. Jansen, Jr., Morrill Hall, or with the Director of the Institute.
**Required Courses to Satisfy University Academic Requirements**

**IN BIOLOGICAL AND PHYSICAL SCIENCES AND MATHEMATICS**

- Biology 401 Human Biology: Elementary Physiology or
- Botany 411 General Botany
- Math 415 Mathematics of Business and Economics or 420 Fundamental Mathematics

**IN ARTS, HUMANITIES, AND SOCIAL SCIENCES**

- Res. Econ. 401 Macro- and Environmental Economics
- Res. Econ. 402 Economics of Resource Use and Growth
- Pol. Sci. 631 Local Government and Politics
- Soc. 400 Introductory Sociology

**OUTSIDE MAJOR DEPARTMENT**

- Eng. 401 Freshman English
- Eng. 501 Expository Writing
- Speech 403 Communications II

**Required Core Courses in Community Development**

- Soc. 500 Social Psychology
- Res. Econ. 507 Introduction to Community Development
- Res. Econ. 508 Applied Community Development
- Res. Econ. 795, 796 Independent investigation in field analysis of a specific problem in a community in the region

**AT LEAST FOUR OF THE FOLLOWING:**

- Admin. 712 Behavior in Organizations
- Bio. 641 General Ecology
- INER 702 Natural Resources Policy
- Res. Econ. 705 Structure, Economic Problems, and Planning of Communities in Non-Urban Environment
- Res. Econ. 701 Applied Statistics
- Res. Econ. 717 Law of Community and Regional Planning
- S & W S 709 Soil Interpretation and Community Planning
- Soc. 560 Rural-Urban Sociology

**Environmental Conservation**

This program is intended to give a broad background for understanding environmental and resource problems and their solutions. Man’s economic activity within our biological ecosystems requires understanding of both subject-matter areas. The development of policies and planning is essential to resolving environmental problems.

Students must develop an option related to career goals. The option consists of eight courses selected with the assistance of the faculty adviser from the offerings of the University. Options center on a variety of conservation-related areas, such as land-use planning, ecological education, pollution control, writing on natural resources, etc. In addition, a student must complete the 10 courses listed below, which make up the core of the environmental conservation program.

A minor of five courses in Environmental Conservation is available for students majoring in other areas.
Students should plan to work for a master’s degree if they wish to be professional conservationists. The undergraduate degree offers an education in environmental conservation with the opportunity for specialization or generalization in related fields.

All students must complete the University general education requirements, page 21.

The following 10 courses are required of all majors:

1. Botany 411 (General Botany);
2. Zoology 412 (Principles of Zoology);
3. and 4. Ecology electives: two of the following: Biology 641 (General Ecology), Botany 741 (Ecosystem Analysis), Botany 742 (Physiological Ecology), Forest Resources 527 (Silvics), Forest Resources 634 (Wildlife Ecology), Forest Resources 672 (Ecological Energetics);
4. Resource Economics 401 (Environmental and Resource Economics) or Resource Economics 402 (Economics of Resource Use);
5. An advanced course in the economics of resources;
6. Resource Economics 706 (Economics of Resource Development) or INER 702 (Natural Resources Policy);
7. Soil and Water Science 504 (Fresh Water Resources);
8. Senior practicum: at least 4 credits, selected from the following, with permission of the instructor in consultation with the student: Forest Resources 695, 696 (Investigations in Forestry), Resource Economics 795, 796 (Investigations in Resource Economics); Soil and Water 795, 796 (Independent Work in Soil and Water). This practicum will be an independent project involving field work on an actual conservation activity during the senior year. A written report will be required. The course may be developed with any faculty member in the Institute of Natural and Environmental Resources.

Students interested in a major or minor may consult with the Program Coordinator, Dr. Oliver Wallace, Pettee Hall, or with the Director of the Institute.

Forest Resources

The objectives of this program are to combine a basic education with a forestry technical education to meet the needs of the professional forester. The Forest Resources program is accredited by the Society of American Foresters.

Graduates are employed in a variety of forest-land management and administrative positions. Some graduates work with natural resource
Institute of Natural and Environmental Resources

protection, utilization, and the development of environmental quality. Others are employed in the production of raw materials, while still others concentrate on wildlife, grazing, watershed, and recreation.

Managerial and administrative skills are required of most forestry graduates. The program gives a strong foundation in both biological knowledge and managerial skills, with elective freedom for the student to cultivate his special abilities and interests. The curriculum leads many students into graduate studies.

Students majoring in Forest Resources complete 134 credit-hours for the degree of Bachelor of Science in Forestry. The University general education requirements (page 21) are met by taking the required courses below and by choosing electives from the following: four courses in arts, humanities, or social sciences; and four courses other than those listed under Forest Resources.

In addition to the normal University fees and tuition, Forest Resources students are required to meet transportation and meal charges in connection with regularly planned field sessions.

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<tr>
<th>FRESHMAN YEAR</th>
<th>FALL</th>
<th>SPRING</th>
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<tbody>
<tr>
<td>For. Res. 425, 426</td>
<td>Dendrology; Wood Technology</td>
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<tr>
<td>English 401</td>
<td>Freshman English</td>
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<tr>
<td>Botany 411</td>
<td>General Botany</td>
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<tr>
<td>Math 427</td>
<td>Calculus I</td>
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</tr>
<tr>
<td>Economics 401</td>
<td>Principles of Economics</td>
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</tr>
<tr>
<td>Advanced English</td>
<td>Writing or Speaking Development</td>
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<tr>
<td>Elective</td>
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<td></td>
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<th>SOPHOMORE YEAR</th>
<th>FALL</th>
<th>SPRING</th>
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<tbody>
<tr>
<td>Science Elective</td>
<td>Chem. 403, Earth Sci. 401, Physics 401, or Zool. 412</td>
<td>4</td>
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<tr>
<td>(one semester)</td>
<td></td>
<td>or 4</td>
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<tr>
<td>Elective</td>
<td>Forest Pathology (Bot. 753)* or Forest Entomology (Ent. 506)</td>
<td>4</td>
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<td>Silvies</td>
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<td>Introductory Soils</td>
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<td>Forest Economics</td>
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<td>For. Res. 527</td>
<td>Math 403 or INER 511</td>
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<td>For. Res. 542</td>
<td>Forestland Surveying</td>
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<td>For. Res. 629</td>
<td>Silviculture</td>
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<td>For. Res. 644</td>
<td>Biometrics</td>
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</tbody>
</table>

*Bot. 753 requires junior class standing.*
Prior to the junior year, each student must choose a single area of concentration from the five-course options listed below, and must elect five courses with that option.

**Forest Management Option:** One course in accounting, management, or administration in WSBE; and four courses in advanced forestry, wildlife, hydrology, soils, resource management, or administration.

**Forest Science Option:** Chem. 404, General Chemistry; Biochem. 501, Biological Chemistry, and Pl. Sci. 706, Plant Physiology, or Chem. 651-652, Organic Chemistry; and two courses in advanced Plant Science, Botany, or Entomology.

**Wood Science Option:** Chem. 404, General Chemistry; Math. 428, Calculus II; two courses in For. Res. 695 (Sec. 3), Investigations in Forest Utilization; and one course in advanced Mathematics, Science, or Engineering.

**Quantitative Science Option:** Math. 428, Calculus II; Math. 527, Differential Equations, or Math 528, Multidimensional Calculus; Math 640, Linear Algebra; a course in probability or statistics; and a course in advanced mathematics, statistics, or computer science.

Students interested in the Forest Resources program may consult with the program coordinator, Dr. Harold Hocker, James Hall, or with the Institute Director.

**Resource Economics**

This program offers training in resource economics, including public resource policy, resource management, conservation economics, and regional economics. Training is also available in agricultural economics, including farm management, food marketing, agricultural policy, and world food supplies.

The student in resource economics is trained primarily in the science of economics and its use in problem-solving by individuals, households, business firms, communities, and administrators of governmental agencies. In addition, the student satisfies University requirements (page 21) leading to a broad university education. Those majors who are interested in the economic or business aspects of agriculture will be expected to take courses in the departments of Animal Sciences and Plant Science.

Students majoring in the social sciences and Life Sciences and Agriculture departments of the University may find it to their advantage to elect courses or a minor in resource economics. In this manner their basic training can be supplemented in a specific area of interest, such
as: farm management and agricultural marketing for agricultural majors, or resource development and natural-resource policy for social science majors.

Students who major in resource economics are qualified for a wide variety of opportunities upon graduation. There is presently a strong demand by private business, public institutions, and government agencies for specialists trained in agricultural, fisheries, and forestry marketing; conservation resource development, community development, and land-use policy; extension-work resident teaching; and farm management. In many cases the student may wish to improve his qualifications by pursuing more specialized graduate studies in one or more of the above areas.

**Required Courses for Resource Economics Majors**

1. All of the following:

   - English 401 Freshman English
   - Res. Econ. 401 Macro- and Environmental Economics
   - Res. Econ. 402 Economics of Resource Use and Growth
   - Soc. 400 Introductory Sociology
   - Bot. 411 General Botany*
   - Zool. 412 Principles of Zoology*
   - S. & W. 501 Introductory Soils*
   - or 504 Fresh Water Resources*
   - Math 420 or 427 Fundamental Mathematics or Calculus
   - Econ. 605 Intermediate Economic Analysis
   - Econ. 611 National Income Analysis
   - Econ. 641 Public Finance
   - Res. Econ. 701 Applied Statistics
   - Res. Econ. 756 Regional Economic Analysis

2. At least four of the following:

   - Res. Econ. 506 Population, Food and Resource Use in Developing Countries
   - Res. Econ. 507 Introduction to Community Problems
   - Res. Econ. 504 Management of Farm and Related Resource Based Business
   - INER 676 Economics of Water Use
   - Res. Econ. 706 Economics of Resource Development
   - Res. Econ. 715 Linear Programming Methods
   - Res. Econ. 795 or 796 Investigations in Resource Economics

*or equivalent to satisfy University science requirement.

Students interested in major or minor in this program may consult with the program coordinator, Dr. James Bowring, Morrill Hall, or with the Institute Director.

**Soil and Water Sciences**

The subject matter of this program relates the physical sciences to the environment. It includes knowledge of the outermost layer of the earth’s crust and that portion of the hydrologic cycle pertaining to the
fate of water falling on the earth’s surface. Knowledge concerning soil and water is important to persons working in the plant sciences, geology, geography, meteorology, natural resource management and pollution control, and certain aspects of engineering. Students interested in soil and water science must select one of the two majors described below by the end of the sophomore year.

**Soil Science:** This major helps the student develop an understanding of the nature and properties of soils as well as their importance to modern society. It includes the study of the chemical and physical properties of soils, their formation, classification, conservation, and management. Soils are evaluated as a resource in urban and rural community planning.

Listed below are the core courses expected of majors. Electives permit freedom to tailor training to a student’s specific interests:

Chem. 403, 404 General
Chem. 517 Quantitative
Physics 407, 408 General
Math 410 Digital Computer
Math. 427, 428 Calculus
Geology 401, 402 Principles
Botany 411 General
Botany 706 Plant Physiol.

**Hydrology:** This is the science underlying development and control of water resources on and beneath the earth’s surface. Because water is a basic requirement of life, it has social, economic, and political significance throughout the world. As the population of the world grows and as industrial, recreational, agricultural, and residential needs for water increase, greater emphasis will be placed on the study and understanding of problems associated with water resources.

Core courses for this major are listed below:

Chem. 403, 404 General
Physics 407, 408 General
Math. 410 Digital Computer
Math. 427, 428 Calculus
Geology 401, 402 Principles
Geology 561 Geomorphology
Geology 662 Glacial

Botany 411 General
Geog. 473 Weather
S&WS 501 Soils and the Environment
S&WS 502 Intro. Soil-Plant Rel.
S&WS 701 Physics of Soils
S&WS 702 Chemistry of Soils
S&WS 704 Soil Classification
S&WS 795, 796 Independent Work
S&WS 710 Ground Water Hydrology
S&WS 795, 796 Independent Work

Students interested in the soil science or hydrology programs may consult with the program coordinator, Dr. Robert Harter, James Hall, or with the Institute Director.

**Wildlife Management**

This curriculum is for students whose interest is in the production, management, and utilization of game and other forms of wildlife.
It is designed to provide a knowledge of wildlife species and of the total forest and field environment of which they are a part. It prepares the student for work with public and private agencies in wildlife management and is a base for graduate study as needed for research and teaching.

Field work is carried out during the academic year on wildlife areas near the campus. In June each year, a two-week session is held for all students who have completed the sophomore year. There is no additional summer camp. Majors are encouraged to obtain summer employment related to their career objective.

The degree earned is a Bachelor of Science with a major in wildlife management. The program is administered in the Institute of Natural and Environmental Resources and is a cooperative program with the departments of Animal Sciences, and Zoology. Inquiries should be addressed to the Institute of Natural and Environmental Resources, Pettte Hall.

In addition to the normal University fees and tuition, students are required to meet transportation and meal charges in connection with regularly planned field sessions.

Students majoring in wildlife management are required to complete 132 credits for the bachelor's degree. In completing the curriculum which follows, the student will meet the University general education requirements (see page 21). These requirements should be met by choosing electives as follows: four courses in arts, humanities, or social sciences; and four courses from the other University requirements. In addition, two electives should be chosen from the following:

Forest Resources: 544, Forest Economics; 629, Silviculture; 644, Forest Biometrics; 745, Forest Management; Soil and Water Science; 501, Introductory Soils; 502, Soil-Plant Relationships; 504, Fresh Water Resources; and INER: 702, Natural Resource Policy, 712, Sampling Techniques, 797, Forest Recreation Seminar.

<table>
<thead>
<tr>
<th>FRESHMAN YEAR</th>
<th>FALL</th>
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<tbody>
<tr>
<td>Bot. 411</td>
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<tr>
<td>Zool. 412</td>
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<tr>
<td>For. Res. 425</td>
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<td>Math. 420</td>
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<tr>
<td>General Botany</td>
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<tr>
<td>Principles of Zoology</td>
<td>4</td>
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<tr>
<td>Dendrology</td>
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<td>Fundamental Mathematics</td>
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<tr>
<td>Macro- and Environmental Economics</td>
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## Sophomore Year

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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>An. Sci. 501</td>
<td>Animal Anatomy and Physiology</td>
<td>4</td>
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<tr>
<td>INER 635</td>
<td>Contemporary Conservation Issues</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 403-404</td>
<td>General Chemistry</td>
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</tr>
<tr>
<td>INER 528</td>
<td>Applied Statistics 1</td>
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<tr>
<td>Zool. 542</td>
<td>Ornithology</td>
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<td>Elective</td>
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**Spring Field Session (June)**

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<td>For. Res. 542</td>
<td>Forest Land Surveying</td>
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## Junior Year

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<tr>
<td>Biochem. 501</td>
<td>Biological Chemistry</td>
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<tr>
<td>Zool. 712</td>
<td>Mammalogy</td>
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<tr>
<td>Biol. 641</td>
<td>Principles of Ecology</td>
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</tr>
<tr>
<td>For. Res. 634</td>
<td>Wildlife Ecology</td>
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</tr>
<tr>
<td>An. Sci. 614</td>
<td>Disease and Parasites of Wildlife</td>
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</tr>
<tr>
<td>Pol. Sci. 402</td>
<td>Introduction to Political Science</td>
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</tr>
<tr>
<td>Math. 403 or INER 511</td>
<td>Computer Programming</td>
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<td>Electives</td>
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## Senior Year

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<tr>
<td>For. Res. 737, 738</td>
<td>Game Management</td>
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<tr>
<td>Zool. 711</td>
<td>Natural History of Cold-blooded Vertebrates</td>
<td>4</td>
</tr>
<tr>
<td>Zool. 772</td>
<td>Fishery Biology</td>
<td>4</td>
</tr>
<tr>
<td>Electives</td>
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<tr>
<td><strong>Total</strong></td>
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</tbody>
</table>

Students interested in the Wildlife Management program may consult with the program coordinator, Dr. David Olson, Pettee Hall, or with the Institute Director.

## Occupational Education

The Occupational Education curriculum provides professional education preparation for teachers of vocational-technical education and county Cooperative Extension personnel. Students whose occupational objective is teaching will satisfy certification requirements by enrolling in the one-semester block program of off-campus teaching. Students whose occupational objective is the Cooperative Extension Service will arrange for field experience with county Cooperative Extension personnel in a county office.

Students desiring a major or minor in this program should consult the professor in charge early in their academic careers.
Plant Science

Students interested in plants and their use for food, feed, fiber, recreation, or ornamental purposes may take a major or minor in plant science. A core curriculum of physical and biological sciences is required. Selected courses then relate these sciences to the individual's specific area of interest. Two curriculum options, the science option and the general option, are offered to plant science majors.

The science option requires additional courses in chemistry, physics, and mathematics. Students are prepared for advanced study leading to careers in research or teaching.

Because of the diversity of employment possibilities, the general option curriculum is flexible. Minor programs in administration, economics, English (journalism), parks and recreation, or occupational education are possible to accommodate specialized interests and complement fundamental requirements. Students will find opportunities in management of farms, greenhouses, golf courses, or nurseries; teaching; journalism; park or highway planning commissions; sales or brokerage aspects of wholesale and retail marketing; and food and feed processing firms.

Students interested in a plant science major or minor may consult with the Department Chairman, Professor L. C. Peirce.

Thompson School of Applied Science
Lewis Roberts, Director

The Thompson School is the two-year division of the College of Life Sciences and Agriculture. High school graduates or the equivalent who have a real interest in furthering their education are admitted.


Two years of academic work on campus, totaling 64 semester credits, plus completion of one summer of supervised placement, lead to the degree of Associate in Applied Science.

Applicants desiring admission to the Forest Technology and Civil Technology curriculums must submit two units of college preparatory mathematics. Applicants for admission to other curricula will find high school courses in biology, chemistry, mathematics, and physics helpful. Each prospective applicant must take the College Board Scholastic Aptitude Test during his senior year in high school.

A catalog may be obtained from the Thompson School of Applied Science, Barton Hall.
College of Technology

Richard S. Davis, Dean
Tenho S. Kauppinen, Assistant Dean
Donald A. Moore, Assistant to the Dean,
Director of Center for Industrial and Institutional Development

Departments
Chemical Engineering
Chemistry
Civil Engineering
Earth Sciences
Electrical Engineering
Mathematics
Mechanical Engineering
Physics

Programs of Study
BACHELOR OF SCIENCE:
Engineering:
- Chemical Engineering
- Civil Engineering
- Electrical Engineering
- Mechanical Engineering
Science and Mathematics:
- Chemistry
- Geology
- Mathematics
- Mathematics Education
- Physics

BACHELOR OF ARTS:
- Chemistry
- Chemistry and Physics Teaching
- Earth Science Teaching
- Geology
- Mathematics
- Physics
- Science
General Information

The College of Technology seeks to provide an optimal opportunity for students to achieve educational objectives appropriate to their interests in engineering, mathematics, and the physical sciences. The College offers a vigorous professional education in each of its eight primary disciplines leading to the Bachelor of Science, and a broad liberal education coupled with a major in mathematics and each of the three physical sciences leading to the Bachelor of Arts. All programs include an opportunity for study in the arts, humanities, and the social sciences.

The key to an undergraduate program in the College of Technology is flexibility with a strong emphasis on personal and individualized education. In addition to specific programs a number of sub-options are available. Special programs can be developed to meet the specific interests of individual students.

The Bachelor of Science

The programs leading to the Bachelor of Science degree, offered in each of the departments of the College, emphasize the preparation of students for a professional career and continuing or graduate education.

The degree requirements for the Bachelor of Science include the University General Education Requirements (Page 21) and the specific departmental requirements for graduation. A minimum grade-point average of 2.0 must be achieved. Graduation credit requirements established by the departments range from 128-134. Since there is a core of courses which are similar in each Bachelor of Science curriculum, it is possible for a student to change his field of study during the sophomore year with little effect on the time required for graduation.

The Bachelor of Arts

Programs leading to a Bachelor of Arts degree are offered in Chemistry, Geology, Mathematics, and Physics. These programs provide a broad liberal education along with a major in one of these physical sciences or mathematics. Students interested in science, but undecided about the field, may enter the College as a science major.

A candidate for the Bachelor of Arts in the College of Technology must complete at least 32 credits of major course work with grades of "C" or better. The student may choose either a departmental major or a science major with a departmental concentration.

In the departmental major, at least 32 credits of course work must be taken within the major department. Up to 12 credits may be required in related departments. (See individual departmental write-ups for specific requirements.)
In the Science Major with Departmental Concentration, 20-24 credits are taken within the department of concentration with the additional credits required taken in other science courses approved by the department of concentration. (See individual departmental write-ups for specific requirements.)

In addition to the departmental requirements, a candidate for the Bachelor of Arts in the College of Technology must meet the University General Education Requirements (Page 21) and the following College requirements:

1. Of the six courses presented to satisfy the University General Education Requirements at least two must be in Arts and Humanities and at least two must be in the Social Sciences.

2. Mathematics 427-428 or the equivalent in transfer credits or advanced placement approved by the Mathematics Department.

3. Foreign language: Proficiency in a foreign language at the level achieved by satisfactory work in a one-year college-level course is required of all students. This requirement may be fulfilled by achieving a score of at least 500 on a College Board foreign language test or by completing a full-year elementary course in any foreign language, or by completing a semester of a course in foreign languages numbered 501 or above, if eligible.

Minor

A student in the College of Technology may earn a minor in any discipline in the University. A minor consists of 20 semester hours with grades of “C” or better in courses that the minor department approves. Courses taken on a Pass/Fail option may not be used for a minor. No more than eight credits used by the student to satisfy requirements in the major may be used for the minor. Students wishing a minor should plan programs in consultation with the major adviser and an adviser from the minor department. During the final term, students should apply to the Dean to have the minor recorded on the transcript.

Interdisciplinary Minors

Interdisciplinary minors have been developed in ocean engineering and bioelectronics engineering. These programs will enable students to obtain experience in the specialized area and to retain identification with their major professional area.

Ocean Engineering

The ocean-engineering minor program consists of core courses which are directly concerned with some aspect of ocean engineering. Successful completion of the minor requires that a student complete a minimum of five core courses. All courses constituting the program
shall be elected by the student in consultation with the adviser in the ocean engineering program.

Core courses in the ocean engineering program are as follows: Botany 525—Introduction to Marine Botany; C.E. 796—Independent Study; M.E. 757—Coastal Engineering and Processes; E.E. 785—Underwater Acoustics; Earth Science 501—Introduction to Oceanography; Earth Science 756—Chemical Oceanography; Earth Science 758—Physical Oceanography; Earth Science 759—Geological Oceanography; M.E. 751—Naval Architecture in Ocean Engineering; M.E. 752—Submersible Vehicle Systems Design; Tech. 610—Introduction to Ocean Engineering; and Tech. 695—Engineering Projects (E.E., M.E., Ch.E., C.E.)—Projects and Independent Study.

Normally the five required core courses chosen from this list will include two courses from the science area. As experience and demand dictate, courses may be added or deleted from the above listings.

A student is encouraged to declare the intention to enter the program as early as possible but no later than the end of the junior year. During the final term, the student should apply to the Dean to have the minor shown on the transcript.

**Bioelectronics Engineering**

Technology students, having an interest in applying their engineering training to problems relating to the health and welfare of our growing population, may wish to participate in the Bioelectronics Engineering Minor. In order to qualify for this minor, the student must choose five of the elective courses from an approved list of courses in consultation with the adviser.

The opportunity exists for students to participate in courses and research projects which involve the Departments of Zoology, Animal Science, Plant Science, Physical Education, Psychology, Forestry, Soil and Water Science, and Departments within the College of Technology.

Listed below are courses which may be elected by the student for this program. The list will be changed as new courses become available.


Exceptions may be made to the above list in special cases. Students will normally begin this program during their sophomore year. During the final term, application should be made to the Dean to have the Minor shown on the transcript.
Dual Major Option

A student may earn two majors in any discipline in the University which awards the Bachelor of Arts degree if authorized by the major departments and the College Dean(s). No more than 8 credits used to satisfy requirements for one major may be used for the other. A student should declare the intent to earn two majors as early as possible and no later than the end of the junior year. The student should plan the program in consultation with advisers from both majors.

Dual Degree Programs

A student may obtain more than one undergraduate degree by completing all the curriculum, departmental, scholastic, and other requirements for each degree. It is expected the student will complete five years of academic work. A second degree may not be earned in a closely allied major field. If a student plans to enter the dual degree program, the respective departments should be contacted as early as possible. See page 24 for specific requirements.

Student Designed Major

See page 125 for requirements for a student designed major.

Independent Study and Projects

All departments within the College offer courses in independent study or in projects. The content of these courses varies with the current scientific and technological needs as well as with student and faculty interest.

Permission of the instructor and/or the department chairman is required. (See the Course Descriptions for the independent study and projects courses and for specific requirements.) The initiative for an independent study course in any area rests with the student.

Special Provisions

"The requirement of a given course in any prescribed curriculum may be waived by the faculty of a student's college. The student's petition must be approved by his major adviser and the Dean of the College. This power will usually be delegated by the faculty to the Dean or to a committee." (Senate Rule 04.31 (s). Waiver of Requirements in a Prescribed Curriculum.)

The above rule offers students the opportunity to develop a somewhat individualized plan of study with intellectual incentives and opportunities beyond those offered in a regular curriculum.

In addition, upon the recommendation of the department chairman, superior students may be allowed to count credits from up to two 800-level courses toward both a bachelor's degree and a master's degree provided that the student has been admitted to the master's program.
Research Opportunity

The talents and expertise of the faculty in all departments is reflected in the number of on-going research projects. Undergraduate students are included in many of these research projects. The intent is to discover and to foster the creative talents of students. In funded research projects, there may be an opportunity for students to be paid while learning.

Some flavor of the multiplicity of the research programs is reflected in special facilities a few of which are listed below:

Analog Computer Facility, Antenna Systems Laboratory, Bioelectronics Laboratory, Computation Science Center, Electronics Laboratory, Engineering Design and Analysis Laboratory, Fluid Mechanics Laboratory, Materials Laboratories, Mechanics Research Laboratory, Sanitary Engineering Laboratory, Solid State Laboratory, Space Science Center, Wind Tunnel and Water Tunnel Facility, and X-Ray Laboratory.

Preparing for Teaching

Students interested in Mathematics Education, Chemistry and Physics Teaching, or Earth Science Teaching should refer to the material on Preparing for Teaching that begins on Page 28 and the appropriate department description of the requirements.

Chemical Engineering
Stephen S. T. Fan, Chairman

Chemical engineering is concerned with the analysis and design of processes and systems that involve the flow and transformation of energy and matter. Its foundations are based in chemistry, physics, and mathematics; its operations are developed from knowledge provided by these disciplines, by the other branches of engineering, and by the applied biological, and social sciences.

The practice of chemical engineering is concerned with the conception, development, design, improvement, and application of processes and their products; the economic development, design, construction, operation, control, and management of plants for these processes; and with public service, education, and research.

Traditional employment areas in the chemical process industries include industrial chemicals, petroleum and petrochemicals, plastics, pharmaceuticals, metals, textiles, food, and energy. Chemical engineers are also working in increasing numbers in the emerging areas of pollution abatement, biochemical and biomedical engineering, ocean engineering, and space exploration. In these developing areas, chemi-
cal engineers are employed by many of the government laboratories and agencies and by private industries and institutions.

The curriculum is designed to provide adequate training for the student to enter the diverse areas of employment or graduate study. The considerable number of electives in the curriculum provides flexibility to individual students and their advisers to design a program that fulfills individual needs and interests. This also provides an opportunity for students to elect minor options in their programs.

A minimum of 128 credits is required for graduation with the degree of Bachelor of Science in Chemical Engineering. There are 10 electives in the chemical engineering curriculum in addition to the mathematics elective. Six of these are for arts and humanities and social science requirements. Among the remaining four electives, two should be chosen from chemical engineering courses.

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<tr>
<th>FRESHMAN YEAR</th>
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<tbody>
<tr>
<td>English 401</td>
<td>Freshman English</td>
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<tr>
<td>Math. 427-428</td>
<td>Calculus I and II</td>
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<td>Phys. 407-408</td>
<td>General Physics I and II</td>
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<td>Chem. 405</td>
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<td>Current Topics in Chemical Technology</td>
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<td>Physical Chemistry I and II</td>
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<td>Chem. 685-686</td>
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<td>Math. 527</td>
<td>Differential Equations</td>
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<td>Math. 403</td>
<td>Introduction to Digital Computer Programming</td>
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<td>Organic Chemistry</td>
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<td>Ch.E. 601</td>
<td>Fluid Mechanics and Unit Operations</td>
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<td>Heat Transfer and Unit Operations</td>
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<tr>
<td>Ch.E. 604</td>
<td>Chemical Engineering Thermodynamics</td>
<td>4</td>
</tr>
<tr>
<td>Electives (2)</td>
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<table>
<thead>
<tr>
<th>SENIOR YEAR</th>
<th>FALL</th>
<th>SPRING</th>
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<tbody>
<tr>
<td>Ch.E. 605</td>
<td>Mass Transfer and Stagewise Operations</td>
<td>4</td>
</tr>
<tr>
<td>Ch.E. 606</td>
<td>Chemical Engineering Kinetics</td>
<td>4</td>
</tr>
<tr>
<td>Ch.E. 608</td>
<td>Chemical Engineering Design</td>
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</tr>
<tr>
<td>Electives (5)</td>
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<td></td>
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</tbody>
</table>
Chemistry
A. R. Amell, Chairman

The student interested in chemistry may major in one of four programs offered in the department. The choice of program depends upon the student's plans for a career. Since the required chemistry courses in each degree program are the same in the first year it is easy to change from one program to another, or even to another major.

Bachelor of Science in Chemistry

This curriculum is intended to prepare the student for the career of a professional chemist and to provide a strong foundation for graduate study in chemistry or in interdisciplinary areas of science calling for a strong background in chemistry. It requires a greater depth in chemistry and physics than do the other degree programs.

Requirements:

1. All University requirements must be satisfied (see page 21).

2. Language requirement: Much of the chemical literature is in German or Russian, and has not been translated. The student must demonstrate a proficiency in one of these languages by completing a year's course in that language. The choice is up to the student.

3. The student should register for Physics 407 in the second semester of the first year.

4. Chemistry requirements: 405, Introductory Chemistry; 406, Quantitative Analysis; 547, Organic Chemistry; 548, Organic Chemistry; 683, Physical Chemistry I; 684, Physical Chemistry II; 685, Physical Chemistry Laboratory; 686, Physical Chemistry Laboratory; 697, Chemical Literature; 698, Seminar; 755, Advanced Organic Chemistry; 762, Instrumental Analysis; 775, Inorganic Chemistry; 776, Physical Chemistry III; and one advanced chemistry or other approved science course, elected by the student.

5. Mathematics requirements: 427, Calculus I; 428, Calculus II; and 403, Introduction to Digital Computer Programming. Math 527 (Differential Equations) and 528 (Multidimensional Calculus) are recommended but not required.

6. Physics requirements: 407, General Physics I; 408, General Physics II; and 506, General Physics IV.

Bachelor of Arts, Chemistry Major

This curriculum offers the student interested in chemistry the opportunity to combine a chemistry major with other interests. There are fewer required courses in chemistry and physics, and the student has more opportunity to elect courses in other areas according to individual
interests. The pre-healing arts students interested in chemistry, those preparing for secondary school teaching, or those interested in business can combine these interests with chemistry in this curriculum.

Requirements:
1. All University requirements must be satisfied (see page 21).
2. All College requirements for the Bachelor of Arts degree must be satisfied (see page 30).
3. Chemistry requirements: 405, Introductory Chemistry, or 403-404, General Chemistry; 406, Quantitative Analysis; 547, Organic Chemistry; 548, Organic Chemistry; 683, Physical Chemistry I; 684, Physical Chemistry II; 685, Physical Chemistry Laboratory; 686, Physical Chemistry Laboratory; 762, Instrumental Analysis; and two advanced chemistry courses elected by the student.

Bachelor of Arts, Science Major, Chemistry Concentration
This curriculum is for the student interested in chemistry, but wishing a broader exposure to other disciplines than is obtained in a chemistry major. Students interested in interdisciplinary science or in chemistry as a cultural subject can satisfy their interests in this degree program. It is not intended to prepare professional chemists but rather as the basis for a broad liberal education.

Requirements:
1. All University requirements must be satisfied (see page 21).
2. All College requirements for the Bachelor of Arts degree must be satisfied (see page 30).
3. Chemistry requirements: 405-406, Introductory Chemistry and Quantitative Analysis, or 403-404, General Chemistry; and four other chemistry courses (each at least three credits) chosen from at least two different areas of chemistry.
4. Additional Major requirements: three approved courses in science or mathematics (each at least three credits) over and above those used to satisfy University requirements.

Bachelor of Arts, Chemistry and Physics Teaching
This major is designed for students who wish to teach chemistry and physics in secondary schools. The number of positions available for teaching only chemistry or physics is limited, and there are many opportunities to teach both subjects on the secondary-school level. Chemistry and Physics Teaching majors will have good preparation for teaching these subjects and will have the necessary mathematics and education background.
In each of the above programs the student should register for the following courses in his first year: Chemistry 405 (1st semester), Introductory Chemistry; Chemistry 406 (2nd semester), Quantitative Analysis; Mathematics 427 (1st semester), Calculus I; Mathematics 428 (2nd semester), Calculus II; and Physics 407 (2nd semester), General Physics I.

Requirements:
1. All University requirements must be satisfied (see page 21).
2. All College requirements for the Bachelor of Arts degree must be satisfied (see page 30).
3. Chemistry requirements: 405, Introductory Chemistry, or 403-404, General Chemistry; 406, Quantitative Analysis; 545 or 547-548, Organic Chemistry; 683, Physical Chemistry I; 684, Physical Chemistry II; 685, Physical Chemistry Laboratory; and 686, Physical Chemistry Laboratory.
4. Physics requirements: 407, General Physics I; 408, General Physics II; 505, General Physics III; 506, General Physics IV; 605, Experimental Physics I; and Physics 406, Introduction to Modern Astronomy, strongly recommended.
5. All education courses in Teacher Preparation Program (see page 28).

Civil Engineering
Louis H. Klotz, Chairman

The Civil Engineer is concerned with the planning, design, and construction of public and private facilities including those for: transportation; the control, purification, and distribution of water; the collection and treatment of waste products; and residential and industrial purposes. Facilities must not only provide safe, efficient service to the users but must, in addition, be compatible with the environment (both natural and human) in which they are placed. Since many of the clients are governmental agencies, the civil engineer must secure the approval of the citizens involved or their elected representatives.

The curriculum rests upon the twin bases of the sciences and the liberal arts. The properties of the substances with which he will work (construction materials, soils, and water) are derived from the science base in a series of courses in the middle years of the curriculum. In the senior year, electives are provided to allow the student to pursue in greater depth any of the major branches of civil engineering (structures, soils and foundations, transportation and urban systems planning, water
use and control, environmental and sanitary engineering, surveying and mapping).

The program will permit the graduate to enter professional practice or to pursue further studies either in Civil Engineering or in one of its associated fields (architecture, planning, land development, government service, etc.).

A minimum of 134 credits is required for graduation with the degree of Bachelor of Science in Civil Engineering. The student, with the assistance of the adviser, should plan a program based on the following suggested distribution of courses which averages 17 credit-hours per semester.

<table>
<thead>
<tr>
<th>FRESHMAN YEAR</th>
<th>FALL</th>
<th>SPRING</th>
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<tbody>
<tr>
<td>Chem. 403 (or 405)</td>
<td>General Chemistry</td>
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<tr>
<td>C.E. 400</td>
<td>Civil Engineering Lectures</td>
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</tr>
<tr>
<td>Engl. 401</td>
<td>Freshman English</td>
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</tr>
<tr>
<td>Math. 403</td>
<td>Introduction to Digital Computer Programming</td>
<td>2</td>
</tr>
<tr>
<td>Math. 427-428</td>
<td>Calculus I and II</td>
<td>4</td>
</tr>
<tr>
<td>C.E. 404</td>
<td>Engineering Computer Applications</td>
<td>2</td>
</tr>
<tr>
<td>Phys. 407</td>
<td>General Physics I</td>
<td>4</td>
</tr>
<tr>
<td>Electives (3)</td>
<td>Arts, Humanities, or Social Science</td>
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<th>SOPHOMORE YEAR</th>
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<tbody>
<tr>
<td>C.E. 523-524</td>
<td>Mechanics I and II</td>
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<tr>
<td>C.E. 505</td>
<td>Surveying</td>
<td>4</td>
</tr>
<tr>
<td>Math. 527</td>
<td>Differential Equations</td>
<td>4</td>
</tr>
<tr>
<td>Phys. 408</td>
<td>General Physics II</td>
<td>4</td>
</tr>
<tr>
<td>C.E. 508</td>
<td>Engineering Graphics</td>
<td>2</td>
</tr>
<tr>
<td>Math Elective (or Tech 601)</td>
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<tr>
<td>Electives (2)</td>
<td>Arts, Humanities, or Social Science</td>
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<thead>
<tr>
<th>JUNIOR YEAR</th>
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<tbody>
<tr>
<td>C.E. 622</td>
<td>Engineering Materials</td>
<td>4</td>
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<tr>
<td>C.E. 681</td>
<td>Structural Analysis I</td>
<td>4</td>
</tr>
<tr>
<td>C.E. 642</td>
<td>Fluid Mechanics</td>
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</tr>
<tr>
<td>E.E. 533</td>
<td>Electronics and Instrumentation for Engineers</td>
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<tr>
<td>C.E. 665</td>
<td>Soil Mechanics</td>
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<tr>
<td>C.E. 643</td>
<td>Sanitary Engineering I</td>
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<tr>
<td>C.E. 682</td>
<td>Structural Design Concepts</td>
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</tr>
<tr>
<td>C.E. 621</td>
<td>Transportation Planning and Design</td>
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<thead>
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<th>SENIOR YEAR</th>
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<tr>
<td>C.E. 685</td>
<td>Indeterminate Structures</td>
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<td>Arts, Humanities, or Social Science</td>
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<td>Free Electives (2)</td>
<td>Any Department except C.E.</td>
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<td>C.E. Electives (3)</td>
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<td>16</td>
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</tbody>
</table>
Electrical engineers seek to provide solutions to real problems involving man's needs for the processing of information and for utilization of electrical energy. By conversion of information in various forms into electrical signals, we are able to transmit it over large distances, amplify it, store it, recover it rapidly, perform calculations with extreme precision and speed, and provide automatic devices for controlling complex operations. By the generation, transmission, distribution, and efficient utilization of electrical power, we are able to provide mankind with his most versatile form of energy.

The essence of engineering is design—the art of economically applying theory and judgment to produce devices, components, and engineering systems for the benefit of mankind. Most design tasks make extensive use of mathematics and physical science, which are emphasized in the first two years of the electrical engineering curriculum. In the third year the student concentrates on basic electrical engineering courses. In the fourth year, he can elect several application courses in digital systems and computers, ocean engineering, bioelectronics, control systems, solid state devices, and communication systems.

Electrical Engineering students may obtain, in addition to their major, an interdisciplinary minor in ocean engineering or bioelectronics engineering (see page 76).

Because electrical engineering has been applied so widely to other fields of learning, medicine and business for example, it is particularly well suited to the dual degree programs described on page 00.

The electrical engineering curriculum is intended to prepare the student for further and more specialized studies in electrical engineering at the graduate level, for immediate employment as an engineer, and for graduate work in related areas, such as business.

A minimum of 131 credits is required for graduation with the degree of Bachelor of Science in Electrical Engineering. The student, with the assistance of his adviser, should plan a program based on the following suggested distribution of courses.

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<thead>
<tr>
<th>FRESHMAN YEAR</th>
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<tbody>
<tr>
<td>English 401</td>
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<tr>
<td>Math. 427, 428</td>
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<tr>
<td>Physics 407-408</td>
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<tr>
<td>Chemistry 405</td>
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<td>E.E. 402</td>
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### Sophomore Year

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<th>Course</th>
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<tbody>
<tr>
<td>Math. 527-528</td>
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<tr>
<td>E.E. 501-502</td>
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<td>M.E. 523</td>
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<td>Electives (2)</td>
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<td>E.E. 515-516</td>
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<td>E.E. 512</td>
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### Junior Year

<table>
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<th>Course</th>
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<tbody>
<tr>
<td>E.E. 503</td>
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<tr>
<td>E.E. 510-511</td>
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<tr>
<td>E.E. 509</td>
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<tr>
<td>E.E. 520</td>
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<tr>
<td>E.E. 517-518</td>
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<td>Electives (2)</td>
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<td><strong>Total</strong></td>
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### Senior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>E.E. 605</td>
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<tr>
<td>M.E. 503</td>
<td>4</td>
</tr>
<tr>
<td>Electives* (6)</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
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</table>

*At least two electives in the senior year will be technical courses. These will be two electrical Engineering 700-level courses (or acceptable substitutes) taken after the student has completed Electrical Engineering 510, Electrical Engineering 518, and Electrical Engineering 520.

### Earth Sciences

**Herbert Tischler, Chairman**

The courses offered in the Department of Earth Sciences cover the broad spectrum of geology and oceanography. They encompass a group of related studies that are concerned with an understanding of the size, shape, and constitution of the earth; the processes that are now, or have formerly been, at work upon its surface and within its interior; its origin; and evolution of life upon it.

The need for people trained in the earth sciences has been emphasized by the search for essential mineral resources, by man's increased concern with intelligent management of his environment, and by expansion of research in both oceanography and extra-terrestrial geology. In addition, the demand for well-trained secondary school teachers of earth science has steadily increased over the past few years.

Four undergraduate degree programs are offered through the Department of Earth Sciences.
Bachelor of Science in Geology

This program represents the strongest concentration in the earth and cognate sciences and is especially well suited for students who plan to continue their studies in graduate school. Beyond a central core of courses there is sufficient flexibility in course selection so that a student may, in consultation with his/her academic adviser, orient the program toward a particular facet of the earth sciences (e.g. mineralogy-petrology, oceanography, geomorphology, paleontology-stratigraphy, etc.).

Requirements:
1. Satisfy the University requirements.
3. Complete a minimum of 12 courses in Earth Science, which should include: E.S. 401-402, Principles of Geology; E.S. 501, Introduction to Oceanography; E.S. 512, Descriptive and Determinative Mineralogy; E.S. 613, Principles of Mineralogy, and/or E.S. 614, Petrography; E.S. 531, Structural Geology; E.S. 561, Geomorphology; E.S. 652, Invertebrate Paleontology; E.S. 754, Sedimentation-Stratigraphy; and three approved Earth Sciences electives.
4. Complete Mathematics 527-528 or approved electives.
5. Complete two additional approved electives.

Bachelor of Arts, Geology Major

This program offers students an opportunity to obtain a broad liberal education and a general background in geology with a greater degree of freedom in choosing electives than in the Bachelor of Science program. By a careful choice of electives a student can prepare for graduate school, business, or industry.

Requirements:
1. Satisfy the University requirements.
2. Satisfy the College requirements for the Bachelor of Arts degree.
3. Complete a minimum of eight courses in the department (with a grade of “C” or better) which should include: E.S. 401-402, Principles of Geology; E.S. 512, Descriptive and Determinative Mineralogy; and five upper level Earth Science courses, two of which must be selected from courses numbered 700 or above.

It is strongly advised that students complete, as early as possible, a year each of college chemistry and physics.

It is also suggested that students include History 521-522, History of Science, in their program.
Bachelor of Arts, Science Major, Earth Sciences, Concentration

This program is for the student who wants a liberal education with a scientific slant to it. It is not designed to produce professional scientists but rather combines the liberal arts with a reasonable exposure to science in general and to earth sciences in particular.

Requirements:
1. Satisfy the University requirements.
2. Satisfy the College requirements for the Bachelor of Arts degree.
3. Complete: E.S. 401-402, Principles of Geology; E.S. 501, Introduction to Oceanography; and three approved Earth Sciences electives.
4. Additional major requirements: three approved courses in science over and above those used to satisfy University requirements.

Bachelor of Arts, Earth Science-Teaching Major

This program is specifically designed to prepare the student to teach earth science in secondary school. Upon graduation from this program students receive full teacher certification which is recognized in most states.

Requirements:
1. Satisfy the University requirements.
2. Satisfy the College requirements for the Bachelor of Arts degree.
4. Complete the secondary school practice teaching block program (a full load for one semester of the senior year).

Mathematics

M. E. Munroe, Chairman

There are five undergraduate degree programs offered through the Department of Mathematics Normally a student will enter one of these specific programs. However, if the following Mathematics courses are taken during the first two years, a student is fully prepared to satisfy the Mathematics requirements in any one of these programs and so may change degree programs at the end of the sophomore year: Math 427, Calculus I; Math 428, Calculus II; Math 510, Mathematical Com-
Computer Problems; Math 527, Differential Equations with Linear Algebra; Math 528, Multidimensional Calculus; and Math 531, Introduction to Abstract Mathematics.

In some programs there are courses outside Mathematics that should be completed in the sophomore year. These are noted in the detailed lists of requirements that follow.

Bachelor of Science in Mathematics

This program represents the strongest concentration in Mathematics of any of the programs offered by the department. Included among the required courses are those usually required for admission to graduate work in Mathematics. Through a judicious choice of electives the student may construct a stronger pre-graduate program or he may slant his program toward a career in business or industry.

Requirements:

1. University requirements must be satisfied and Physics 407-408 must be included among the science courses.
2. Language requirement: The student must demonstrate proficiency in one of the three languages: French, German, or Russian. This may be done by achievement test or by courses as outlined in the College requirements for the Bachelor of Arts degree.
3. Mathematics requirements: Math 427, Calculus I; Math 428, Calculus II; Math 510, Mathematical Computer Problems; Math 527, Differential Equations with Linear Algebra; Math 528, Multidimensional Calculus; Math 531, Introduction to Abstract Mathematics; Math 761, Abstract Algebra; Math 762, Linear Algebra; Math 767, One-dimensional Analysis; Math 784, Topology; Math 788, Complex Analysis; and three approved Mathematics electives.

Bachelor of Arts, Mathematics Major

This program offers an opportunity for a broader liberal education than do any of the Bachelor of Science programs. However, by a careful choice of electives the student can shape his major into a preparation for graduate school, business, or industry.

Requirements:

1. University requirements must be satisfied.
2. College requirements for the Bachelor of Arts degree must be satisfied.
3. Mathematics requirements. (note that Calculus is included among College requirements): Math 527, Differential Equations with Linear Algebra; Math 528, Multidimensional Calculus; Math 531, Introduction to Abstract Mathematics; Math 761, Abstract Algebra; Math
Bachelor of Arts, Science Major, Mathematics Concentration

This program is for the student who wants a liberal education with a scientific slant to it. It is not designed to produce professional scientists but rather combines the Liberal Arts with a reasonable exposure to Science in general and Mathematics in particular.

Requirements:

1. University requirements must be satisfied.
2. College requirements for the Bachelor of Arts degree must be satisfied.
3. Mathematics requirements (note that Calculus is included among College requirements): Math 510, Mathematical Computer Problems; Math 527, Differential Equations with Linear Algebra; Math 528, Multidimensional Calculus; Math 531, Introduction to Abstract Mathematics; Math 761, Abstract Algebra, or Math 767, One-dimensional Analysis; and one approved Mathematics elective.
4. Additional major requirements: Three approved courses in science over and above those used to satisfy University requirements.

Bachelor of Science in Mathematics-Education

This is a professional program to prepare the student for secondary Mathematics teaching. While most secondary teachers eventually do graduate work, this program prepares the student to enter the teaching profession immediately on graduation with full teacher certification good in most states.

Requirements:

1. University requirements must be satisfied and Education 481 and 657 must be included among the social science courses.
2. Mathematics requirements: Math 427, Calculus I; Math 428, Calculus II; Math 510, Mathematical Computer Problems; Math 527, Differential Equations with Linear Algebra; Math 528, Multidimensional Calculus; Math 531, Introduction to Abstract Mathematics; Math 636, Probability and Statistics; Math 657, Geometry; Math 698, Senior Seminar; Math 761, Abstract Algebra; and two approved Mathematics electives.
3. Practice-teaching block: This is a full load for one semester of the senior year.
Bachelor of Science (Interdisciplinary Programs in Mathematics and Its Applications).

These programs are designed to prepare the student for employment in various areas of Applied Mathematics. Certain of them also lead to graduate work in appropriate fields (e.g. chemical physics, computer science, economics). In this program the major may consist of Mathematics combined with any one of the following disciplines: Chemistry, Computer Science, Economics, Electrical Science, Control Theory, Fluid Dynamics, Mechanics, Thermodynamics, and Physics.

Requirements:

1. University requirements must be satisfied.
2. Core mathematics requirements: Math 427, Calculus I; Math 428, Calculus II; Math 510, Mathematical Computer Problems, or Math 410, Digital Computer Systems; Math 527, Differential Equations with Linear Algebra; Math 528, Multidimensional Calculus; and Math 645, Analysis for Applications I.
3. Additional Mathematics requirements:
   In Mathematics–Computer Science: Four approved Mathematics electives. Proper choice of these depends heavily on the student’s career objectives. These electives should be chosen only in consultation with a faculty adviser designated by the Mathematics Department.
   In Mathematics–Economics: Math 735, Probability; Math 736, Statistics; and two approved Mathematics electives.
   In all other options: Math 646, Analysis for Applications II; Math 647, Complex Analysis for Applications; and two approved Mathematics electives.
4. Requirements in other disciplines: Each interdisciplinary major consists of 10 Mathematics courses (see above) plus five courses in the other discipline. Specific requirements follow. If more than five courses outside Mathematics are required or elected, the excess over five may be used to satisfy appropriate University requirements.

Mathematics–Chemistry Option

Chem. 405—Introductory Chemistry; Chem. 683—Physical Chemistry I and Chem. 685—Physical Chemistry Laboratory (these two courses regarded as a single unit); Chem. 684—Physical Chemistry II and Chem. 686—Physical Chemistry Laboratory (these two courses regarded as a single unit); Chem. 776—Physical Chemistry III; either Physics 701—Introduction to Quantum Mechanics or Chem. 775—Inorganic Chemistry.

Note: Chem. 547-548, Organic Chemistry, suggested as elective for those planning to do graduate work in chemical physics. Chemistry 405 should be taken no later than the sophomore year.
Mathematics—Computer Science Option


Mathematics—Economics Option

Economics 401-402—Principles of Economics (Macro, Micro); Economics 605—Intermediate Economic Analysis; Economics 611—National Income Analysis; and any two of the following three courses: Economics 727—Introduction to Econometrics; Economics 728—Statistical Decision-Making; Administration 705—Operations Research.

Note: Economics 401-402 should be taken no later than the sophomore year.

Mathematics—Electrical-Science Option


Mathematics—Control-Theory Option


Mathematics—Fluid-Dynamics Option

M.E. 503—Thermodynamics I; M.E. 508—Fluid Dynamics; M.E. 523—Solid Mechanics I; M.E. 707—Analytical Fluid Dynamics; M.E. 708—Gas Dynamics.

Mathematics—Mechanics Option

M.E. 503—Thermodynamics I; M.E. 523-524—Solid Mechanics I and II; any two of the following three courses: M.E. 723—Advanced Dynamics; M.E. 724—Introduction to Vibrations; and M.E. 727—Advanced Mechanics of Solids.

Mathematics—Thermodynamics Option

M.E. 503—Thermodynamics I; M.E. 508—Fluid Dynamics; M.E. 523—Solid Mechanics I; and any two of the following three courses M.E. 701—Macroscopic Thermodynamics; M.E. 702—Statistical Thermodynamics; M.E. 703—Heat Transfer.
Mechanical Engineering

Mathematics-Physics Option

Physics 407-408—General Physics I and II; Physics 505-506—General Physics III and IV; and either Physics 701—Introduction to Quantum Mechanics, and Physics 702—Atomic and Nuclear Physics; or Physics 703-704—Electricity and Magnetism I and II.

Note: Physics 407-408 should be taken no later than the sophomore year.

Mechanical Engineering
William Mosberg, Chairman

Mechanical engineering is a challenging profession encompassing a broad spectrum of activity. It contributes to the research; design; development; and production of aerospace vehicles, underwater vessels, instrumentation and control systems, nuclear and conventional power plants, and consumer and industrial products in general. The profession also makes contributions through more fundamental studies of material behavior, the mechanics of solids and fluids, and energy transformation.

The curriculum in mechanical engineering is designed to prepare the prospective graduate either for more advanced studies or for beginning a professional engineering career. To accomplish these objectives, the program of study provides a foundation in the basic physical sciences, mechanics of solids and fluids, dynamic systems, thermal sciences, materials science, and design. Flexibility in the curriculum enables the student to gain competence in any of these specific areas, developing his abilities in analysis, experimentation, and engineering design. The curricula includes elective courses in the arts, the humanities, and the social sciences to provide a liberal education.

The program in mechanical engineering is further designed to develop the student's creative potential to enable him to meet the increasingly complex needs of industry, government, and education, while appreciating the role of technology in a modern society.

The student, with the assistance of his adviser, should plan a program based on the following distribution of courses which average 16 credit hours per semester but totaling not less than 130 credits.

The outline which follows is to be considered as being typical only in terms of format. Within the constraints of satisfying all of the requirements and having all necessary prerequisites, an individual student's schedule may vary from the following. Such variation will in general be caused by scheduling needs or student preference.

93
All elective courses will be chosen, in consultation with a departmental adviser, from courses which will lead to a balanced program in the student's chosen area of interest. The free electives are entirely the student's own choice and are without constraint.

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<thead>
<tr>
<th>FRESHMAN YEAR</th>
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* A University freshman English course in reading and composition is required of all undergraduates unless specifically exempted on the basis of a written English proficiency examination.

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**Physics**

Robert E. Houston, Jr., Chairman

Physics is concerned with the properties of matter and the laws which describe its behavior. It is an exact science based on precise measurement, and its objective is the kind of understanding that leads to the formulation of mathematical relationships between measured
quantities. As a fundamental science its discoveries and laws are basic to understanding in nearly all areas of science and technology. Advances in such diverse fields as diagnostic medical techniques, transistors, and air pollution have relied heavily on the application of basic physical laws and principles.

Students interested in the study of physics at the University of New Hampshire will find a strong interaction between research and academic programs. Undergraduates have participated in research studies ranging from atomic spectroscopy using laser sources to astrophysical studies of the solar system using space probes. These experiences have proven very beneficial to engineering as well as physics students alike. The student-faculty ratio in Physics is quite low so that considerable faculty contact with students is encouraged. Strong efforts are being made to utilize the IBM 360 remote access terminals in undergraduate courses at all levels. The department also has its own library which provides a comfortable, inviting atmosphere for study and relaxed reading.

The suggested programs below are indicative of the flexibility available to students whether they are preparing for graduate work in physics, industrial opportunities, governmental research, secondary level teaching, or a general education which might utilize the fundamental knowledge of physics.

The following undergraduate degree programs are offered through the Department of Physics.

**Bachelor of Arts, Science Major, Physics Concentration**

This is the most flexible degree offered by the Department. It is not designed to produce a professional physicist, but rather to provide an opportunity for interdisciplinary combinations with emphasis on physics.

**Requirements:**

1. University requirements must be satisfied (page 21).
2. College requirements for the Bachelor of Arts degree must be satisfied (page 30).
3. Physics requirements: six courses.
4. Any three approved courses in science not used to satisfy other University requirements.

**Bachelor of Arts, Physics Major**

This degree provides an opportunity for a broad and liberal education which in some cases may be sufficient for graduate work. A judicious choice of electives may also prepare the student in a restricted area in physics in conjunction with other disciplines or other less technical applications in the field of physics.
Requirements:
1. University requirements must be satisfied (page 21).
2. College requirements for the Bachelor of Arts degree must be satisfied (page 30).
3. Physics 401-402 or 407-408; 505; 506. Note that Mathematics 427-428 are prerequisites for some of the courses.
4. Four additional courses in Physics, any two of which must be at the 500 level or above.

Bachelor of Arts, Chemistry and Physics Teaching
This degree is professional, a preparation for secondary-level teaching. Current regulations in most secondary positions require some graduate work in special courses for which this program is basic. Furthermore, this degree provides preparation for a student to enter a secondary-level position immediately upon graduation with full teacher certification in most states.

Requirements:
1. University requirements must be satisfied (page 21).
2. College requirements for the Bachelor of Arts degree must be satisfied (page 30).
3. Physics requirements: 407-408; 505-506; 605. Physics 406 (astronomy) is strongly recommended.
4. Chemistry requirements: 405-506; 545; 683-684 or 785.
5. Practice-teaching block plus all education courses in the Secondary School Teacher Preparation Program.
6. The student must comply with these Education Department requirements: the student must have a cumulative average of 2.2, an average of 2.5 in the required Chemistry and Physics courses, and 2.5 in the required education courses.

Bachelor of Science in Physics
This degree is the professional program offered by the department. The required courses are those necessary for admission to graduate work or a career in industry. Additional courses may be beneficial for graduate preparation or may be desirable for more depth in certain areas of physics.

Requirements:
1. University requirements must be satisfied (page 21).
2. College requirements for the Bachelor of Science degree must be satisfied (page 30).
3. One course in English is required in addition to the University requirement.
4. Language Requirement: The student is strongly advised to demonstrate proficiency in French, German, or Russian.

5. Minimum Physics Requirements: 407, General Physics I; 408, General Physics II; 505, General Physics III; 506, General Physics IV; 605, Experimental Physics I; 606, Experimental Physics II; 609, Experimental Physics III (normally taken senior year); 616, Physical Mechanics I (normally taken second semester sophomore year); 617, Physical Mechanics II; 701, Quantum Mechanics; and 703-704, Electricity and Magnetism I and II (should be taken in the junior year).

6. Additional Physics courses may be selected from the following: 510, Cosmology; 602, Thermal Physics; 607, Physical Optics; 610, Experimental Physics IV; 613-614, Special Topics; 695-696, Independent Study; and 702, Atomic and Nuclear Physics.

7. Chemistry: 403 and 404 or Chemistry 405.

School of Health Studies

Lawrence W. Slanetz, Dean

Departments
Nursing
Occupational Therapy
Physical Education

Programs of Study
BACHELOR OF SCIENCE:
Medical Technology
Nursing
Occupational Therapy
Physical Education
Recreation and Parks
The School of Health Studies was established in 1968 to provide more effective autonomy, coordination, and leadership for programs in the health-related professions. The basic purpose of the School is to offer undergraduate instruction of high quality leading to Bachelor of Science degrees in Medical Technology, Nursing, Occupational Therapy, Physical Education, or Recreation and Parks. Each professional program is designed to enable students to obtain a broad cultural background in the humanities and social sciences and the basic knowledge and skills essential to the practice of each profession.

Degree Requirements

Each candidate for a degree must satisfy all general University requirements for graduation as listed on page 21, earn at least 128 credits, including the courses required in one of the curricula described below; and achieve a minimum grade-point average in his curriculum as prescribed. Generally, courses are to be completed in the sequence in which they are arranged.

An undergraduate student may select a major upon entering the school or declare a major in the school no later than the end of the sophomore year.

Minor Option

A minor may be earned in other undergraduate disciplines in the University contingent upon approval of both the major and minor departments. A minor consists of 20 credits, with C or better, in courses which the adviser in the minor discipline approves. No more than 8 credits used by the student to satisfy curriculum requirements in the major may be used for the minor. Courses taken on the Pass-Fail basis may not be used for a minor. The intention to earn a minor should be declared as early as possible and no later than the end of the junior year. During the final term application should be made to the Dean to have the minor shown on the transcript.

Dual Degree Programs

A student may obtain more than one undergraduate degree by completing all the curriculum, departmental, scholastic, and other requirements for each degree. It is expected five years of academic work will be needed. A second degree may not be earned in the same or closely allied major field. See page 24 for specific requirements.

If a student plans to take one of the two degrees in the College of Technology, he should register as a freshman in that College. Otherwise, he may register in any of the other Colleges or Schools. When a
School of Health Studies

A student is accepted as a two-degree candidate, supervisors for each major will be appointed. Students who wish to be in this program should confer with the appropriate dean(s) as early in their college careers as possible.

Student Designed Major

See page 125 for requirements for student designed major.

Medical Technology

Medical Technology is a challenging and rewarding health profession for students interested in laboratory medicine. Working with pathologists and other physicians, the medical technologist is a vital member of the health team and performs various medical laboratory procedures and provides the diagnostic assistance required in modern patient care. The medical technologist may also become a member of a research team at medical or hospital centers.

Students who are interested in this field should register in the curriculum in medical technology. In this program students will take their freshman, sophomore, and junior years’ work at the University and their last year’s work at the Mary Hitchcock Memorial Hospital School of Medical Technology, Hanover, New Hampshire. After satisfactorily completing the courses at the School of Medical Technology (Medical Technology 761-762), the student is awarded 32 credits toward the Bachelor of Science degree.

This program also qualifies the student for the examination for the medical technologist’s certificate administered by the Registry of Medical Technologists of American Society of Clinical Pathologists. Thus, a student can obtain the B.S. degree from the University and the M.T. certificate in a four-year period. Students who complete this curriculum are well qualified for work in any hospital or medical laboratory.

Costs for the senior year include a University charge of $800 and a maintenance charge of $1,000 (includes room and board) at the Mary Hitchcock School of Medical Technology.

Students in the medical technology curriculum must obtain grades of C or better in 24 semester credits from the following courses: Zoology 507-508; Microbiology 503, 702, 705; Chemistry 517, 545; and Biochemistry 656.

Students interested in the curriculum in medical technology are advised to consult with Professor Gary S. Moore, supervisor of the program.
### Nursing

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<th>FRESHMAN YEAR</th>
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<td>Engl. 401</td>
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* Students must select courses to satisfy the University general education requirements.
† This course starts about July 6, at the Mary Hitchcock Memorial Hospital School of Medical Technology and includes lecture and laboratory work in microbiology, blood bank and serology, clinical chemistry, hematology, laboratory management and ethics, mycology, parasitology, histology, and clinical microscopy. The credits are awarded in time for graduation in June of the following year after receipt of an official transcript of the grades obtained at the School of Medical Technology and certification by the director of this school and the supervisor of the curriculum that the work has been successfully completed.

### Nursing

The nursing faculty of the University is responsible for the nursing courses. Learning experiences (nursing laboratories) are arranged in hospitals in the area and in community-health and other health agencies.

Graduates of the B.S. program in nursing will have received preparation in professional education with an emphasis on the social, physical, biological, and nursing sciences. They receive a Bachelor of Science degree and are eligible to take State Board examinations to become registered nurses. The program is accredited by the National League for Nursing.

The professional nurse is prepared to assume positions in nursing in institutional and community agencies, providing high quality care to people of all ages in a variety of circumstances. She is needed in hos-
pitals, nursing homes, home health agencies, etc. She is concerned with the individual who is ill and also with health of the individual and his family. Her role here includes teaching people the concepts of health maintenance. She works with other health practitioners to promote good health and to care for the ill. The graduate of this program is ready to assume beginning leadership positions and to continue her education through graduate study.

Students are responsible for their own transportation to the nursing laboratories and for the cost of a uniform before the first nursing course. A physical examination and selected immunizations are required within six months prior to the first clinical nursing course. The cost is borne by the student.

Students in the nursing program must obtain a grade-point average of 2.0 or better for the nursing courses by the end of the first semester of the junior year and must have made satisfactory progress in theory and nursing laboratory. It is expected that the total cumulative average of nursing courses will be 2.2 or better by the senior year. This curriculum requires 128 credits for graduation. Special scholarships and loans are available for the students.

Students interested in the program should consult with the chairman of the department. Challenge examinations are available to the R.N. in several areas both in general education and Nursing.

Admission to the University does not guarantee admission to the Nursing program even though other selection criteria are met. The Department revises the curriculum to reflect trends in professional nursing education and the health field. Therefore, the curriculum as presented is subject to change.

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**FRESHMAN YEAR**

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*Prerequisite to Nursing Courses.
Occupational Therapy

JUNIOR YEAR
Nursing 601 Medical-Surgical Nursing 12
Nursing 602 Family Nursing 12
Electives (2) 4 4

16 16

SENIOR YEAR
Nursing 621-622 Mental Health-Psychiatric Nursing 4 4
Nursing 631-632 Community Nursing 4 4
Nursing 701-702 Contemporary Problems 4 4
Electives (2) 4 4

16 16

Note: A curriculum change is projected for 1973 based upon findings of a federally funded curriculum study initiated in 1971.

Occupational Therapy

The occupational therapist is a professional member of the medical and community health-care team. Through a systematic application of a knowledge of human functioning and of functional activity, the occupational therapist assists in the prevention, correction, or restoration of physical, social, and emotional disabilities.

The current curriculum was fully accredited in 1972 by the American Occupational Therapy Association and the Council on Medical Education, American Medical Association. Two years of pre-professional study and two years of professional study constitute the prescribed program leading to the Bachelor of Science degree. The program includes theoretical studies in biological and medical sciences, in psycho-social science, in the evaluation of patient and activity, and in the planning and administration of treatment, as well as the development of practical skills in a wide range of therapeutic media. Preclinical observation and guided practice of patient treatment in local clinical situations are incorporated in the course requirements. Following completion of the four-year academic program, the student spends a minimum of nine months in supervised clinical practice. A certificate of completion of professional study is then awarded, and the student is certified as eligible to sit for the national registration examination.

Admission to the program is primarily at the freshman level. When enrollment permits, students may enter by declaration at the end of the freshman year or by transfer into the sophomore class.

A student must have achieved a 2.2 overall cumulative average by the end of the first semester, sophomore year. The student also must have completed two one-week preclinical experiences and have obtained
School of Health Studies

a grade of C or better in Psych. 401, 545; Zool. 507, 508; and OT 411, 412 and 580 by the end of the sophomore year in order to continue in the program.

Graduation requirements include participation in three one-week preclinical experiences, a 2.5 cumulative average in the courses prescribed in the major, and a grade of "C" or better in P.E. 606, 652; and OT 520, 524, 526, 583, 584 and 627.

Upon satisfactory completion of the four-year degree program the department will schedule a minimum of nine months of supervised clinical practice for each student. These affiliations will be scheduled in centers which have established educational programs approved by this curriculum. The affiliations are divided in three-month periods as follows: OT 711, General Medicine, Surgery, and Pediatrics; OT 712, Psychiatry; OT 713, Physical Disabilities and Rehabilitation. Students pay the affiliation fee (resident $95; non-resident $200) and register for these affiliations prior to graduation. Owing to a scarcity of affiliation opportunities, the University will accept responsibility for scheduling affiliations only once for each student.

Students should be prepared to provide uniforms as required and to meet all living and traveling expenses during the affiliation period. At times the centers may provide maintenance but this cannot be assured. A physical examination with a tuberculin test is required prior to affiliating.

Eligible graduates make application for the June or January national registration examination through the department. A $25 fee is charged by the American Occupational Therapy Association for this examination.

Students interested in this program are encouraged to consult the Chairman of the Department, Professor Virginia Bell.

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### Physical Education

#### Junior Year

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<td>O.T. 520</td>
<td>Treatment Media II</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Pre-Clinical§</td>
<td></td>
</tr>
<tr>
<td>P.E. 606</td>
<td>Neurology</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16</td>
</tr>
</tbody>
</table>

**Total Credits:** 18

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>O.T. 711 or</td>
<td>First Affiliation</td>
<td>0</td>
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<tr>
<td>712</td>
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### Senior Year

<table>
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<tr>
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<tbody>
<tr>
<td>O.T. 524</td>
<td>Occupational Therapy Theory II—Psycho-Social</td>
<td>4</td>
</tr>
<tr>
<td>O.T. 627</td>
<td>Occupational Therapy Theory IV—Advanced</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Physical Dysfunction</td>
<td></td>
</tr>
<tr>
<td>Arts 419*</td>
<td>Weaving</td>
<td>2</td>
</tr>
<tr>
<td>O.T. 698§</td>
<td>Senior Seminar</td>
<td>2</td>
</tr>
<tr>
<td>Electives (GER) (4)</td>
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<tr>
<td></td>
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</table>

**Total Credits:** 16

### Clinical Affiliations

<table>
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<tr>
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<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>O.T. 711 or</td>
<td>General Medicine, Surgery, and Pediatrics</td>
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</tr>
<tr>
<td>712</td>
<td>Psychiatry</td>
<td>0</td>
</tr>
<tr>
<td>O.T. 713</td>
<td>Physical Disabilities and Rehabilitation</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>American Occupational Therapy Association</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Registration Examination Last Friday of June.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

---

* May be taken Pass-Fail.

‡ A one week experience arranged with the student and clinical facility.

§ Course extends over two semesters—grade being assigned at the end of the second semester.

---

**Physical Education**

The Department of Physical Education offers two programs of study for major students: the Non-Teacher Certification Degree Option and the Teacher Certification Program.

The Non-Teacher Certification Degree Option is designed for those students who are interested in pursuing intensive study in the art and science of human movement. It is assumed that students following this program will continue into graduate study. Students majoring in the option must earn a grade of C or better in each of nine courses (36 credits) in Physical Education; furthermore, students will be encouraged to develop a strong minor in a related discipline or collateral area.

The Teacher Certification Program is designed to provide individuals with a specialized professional background and a broad general
School of Health Studies

education. A student may elect to pursue coursework to prepare as a generalist (all grade levels), or as either an elementary or secondary specialist in physical education. The program provides an opportunity for students to teach physical education, prior to graduation, under supervision in nearby schools. A cumulative grade-point average of 2.2 and a grade-point average of 2.5 in all physical education courses are required to be eligible for the student teaching block program.

Students who wish to minor in Physical Education must complete 20 credits of coursework which have been approved by a Department minor adviser.

Students who are interested in either majoring or minoring in Physical Education should consult with the chairman of the department, Professor Robert Kertzer. The major curricula are open to those students who have been approved by the Department.

All students majoring in Physical Education must complete the following Core courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.E. 620</td>
<td>Physiology of Exercise</td>
<td>4</td>
</tr>
<tr>
<td>P.E. 625</td>
<td>Dynamics of Human Movement</td>
<td>4</td>
</tr>
<tr>
<td>P.E. 775</td>
<td>Perceptual Motor Learning</td>
<td>4</td>
</tr>
</tbody>
</table>

One of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.E. 633</td>
<td>Social Foundations of Sport and Physical Activity</td>
<td>4</td>
</tr>
<tr>
<td>P.E. 635</td>
<td>Contemporary Literature in the Socio-Cultural Aspects of Sport and Play</td>
<td>4</td>
</tr>
<tr>
<td>P.E. 637</td>
<td>An Ethological Theory of Play</td>
<td>4</td>
</tr>
<tr>
<td>P.E. 641</td>
<td>The Dance</td>
<td>4</td>
</tr>
</tbody>
</table>

During the freshman year, students interested in majoring in Physical Education should complete the following coursework:

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engl. 401</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P.E. 441, 442</td>
<td></td>
<td>1 1</td>
</tr>
<tr>
<td>P.E. 411, 421; 412, 422</td>
<td></td>
<td>1 1</td>
</tr>
<tr>
<td>P.E. 453</td>
<td></td>
<td>4</td>
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<tr>
<td>Psych. 401*</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Soc. 400 or 411*</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Electives (2)†</td>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>

* Partially fulfills University Academic Requirements.
† Must be used towards completing University Academic Requirements.
Non-Teacher Certification Degree Option

In addition to the Core and the recommended freshman-year courses, students pursuing this program must complete the following required coursework as upperclassmen:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.E. 440 sequence</td>
<td></td>
</tr>
<tr>
<td>Physical Education Activities for Men</td>
<td>6</td>
</tr>
<tr>
<td>P.E. 410, 420 sequence</td>
<td></td>
</tr>
<tr>
<td>Physical Education Activities for Women</td>
<td>4</td>
</tr>
</tbody>
</table>

One of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psych. 601</td>
<td></td>
</tr>
<tr>
<td>Statistics and Methodology in Psychology</td>
<td>4</td>
</tr>
<tr>
<td>Res. Econ. 701</td>
<td></td>
</tr>
<tr>
<td>Applied Statistics</td>
<td>4</td>
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<tr>
<td>Soc. 602</td>
<td></td>
</tr>
<tr>
<td>Statistics</td>
<td>4</td>
</tr>
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</table>

One of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.E. 510</td>
<td></td>
</tr>
<tr>
<td>Medical Aspects of Sports and Physical Education</td>
<td>4</td>
</tr>
<tr>
<td>P.E. 540</td>
<td></td>
</tr>
<tr>
<td>Motor Efficiency and Impairment in Children and Adolescents</td>
<td>4</td>
</tr>
<tr>
<td>P.E. 780</td>
<td></td>
</tr>
<tr>
<td>Psychological Factors in Sport</td>
<td>4</td>
</tr>
</tbody>
</table>

Or, any course(s) in the Core not taken by the student to fulfill the Core requirements.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.E. 696</td>
<td></td>
</tr>
<tr>
<td>Independent Study</td>
<td></td>
</tr>
<tr>
<td>(To be taken in the senior year)</td>
<td>4</td>
</tr>
</tbody>
</table>

Teacher Certification Program

In addition to the Core and the recommended freshman-year courses, students wishing to obtain public school teaching certification in Physical Education must complete the following required course-work as upperclassmen:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.E. 440 sequence</td>
<td></td>
</tr>
<tr>
<td>Physical Education Activities for Men</td>
<td>8</td>
</tr>
<tr>
<td>P.E. 410, 420 sequence</td>
<td></td>
</tr>
<tr>
<td>Physical Education Activities for Women</td>
<td>6</td>
</tr>
<tr>
<td>P.E. 668</td>
<td></td>
</tr>
<tr>
<td>Measurement Procedures in Physical Education</td>
<td>4</td>
</tr>
</tbody>
</table>

One of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.E. 563</td>
<td></td>
</tr>
<tr>
<td>The Theory of Teaching Physical Education in the Secondary School (required for the generalist and secondary specialist)</td>
<td>4</td>
</tr>
<tr>
<td>P.E. 692</td>
<td></td>
</tr>
<tr>
<td>The Theory of Teaching Physical Education in the Elementary School (required for generalist and elementary specialist)</td>
<td>4</td>
</tr>
</tbody>
</table>

One of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>H.E. 525</td>
<td></td>
</tr>
<tr>
<td>Human Development</td>
<td></td>
</tr>
<tr>
<td>P.E. 540</td>
<td></td>
</tr>
<tr>
<td>Motor Efficiency and Impairment in Children and Adolescents</td>
<td>4</td>
</tr>
<tr>
<td>Psych. 575</td>
<td></td>
</tr>
<tr>
<td>Development of the Normal and Exceptional Child</td>
<td>4</td>
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</tbody>
</table>
School of Health Studies

EDUCATION COURSES

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ed 481 or</td>
<td>An Educational Psychology of Development</td>
<td>4</td>
</tr>
<tr>
<td>H.E. 525 and</td>
<td>Human Development</td>
<td>4</td>
</tr>
<tr>
<td>Ed. 657</td>
<td>Principles of Human Learning</td>
<td>4</td>
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</tbody>
</table>

STUDENT TEACHING BLOCK

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Ed. 658</td>
<td>Principles of Teaching</td>
<td>4</td>
</tr>
<tr>
<td>Ed. 659</td>
<td>Principles of Education</td>
<td>4</td>
</tr>
<tr>
<td>Ed. 694</td>
<td>Directed Teaching of Physical Education</td>
<td>6</td>
</tr>
<tr>
<td>P.E. 697</td>
<td>Senior Seminar in Physical Education</td>
<td>4</td>
</tr>
</tbody>
</table>

Recreation and Parks

The intent of the undergraduate program in Recreation and Parks is to prepare graduates for service in the administration, programming, and management of facilities and leisure-oriented agencies. The courses of study in each area are designed to provide a base in the fundamentals of recreation specialization and to provide an exposure to the current sociological, environmental, and leisure trends and needs of a rapidly changing society and economy.

General Program Requirements

Students who have declared a major in Recreation and Parks must complete the following:

1. Professional Education: A minimum of 36 hours of recreation and park courses;
2. Field Work: A minimum of eight weeks of full-time, on-the-job experience;
3. Professional Option: A minimum of 20 recommended hours from an allied area of study; and
4. Electives: A minimum of 32 hours to satisfy University academic requirements.

Professional Curriculum Options

The School of Health Studies offers professional options in Recreation and Park Administration, Recreation and Leisure Programming, and Park Management, which lead to a Bachelor of Science degree in Recreation and Parks.

Interested students are advised to consult with Gus C. Zaso, chairman of the program.
Recreation and Parks

Recreation and Park Administration

This specialization is designed to identify and develop the abilities which will prepare the student for executive positions in the recreation and park field. Students selecting this option are required to complete 128 credit hours for the degree.

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pol. Sci. 401</td>
<td>4</td>
<td></td>
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<tr>
<td>Biol. 402</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Res. Econ. 401</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>RP 455</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>RP 457</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Electives (3)</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td><strong>16</strong></td>
<td><strong>16</strong></td>
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<table>
<thead>
<tr>
<th>Sophomore Year</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro. 501</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Civ. Eng. 501</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Pol. Sci. 631</td>
<td>4</td>
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</tr>
<tr>
<td>Pol. Sci. 630</td>
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<td>RP 661</td>
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<td>Res. Econ. 507</td>
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<tr>
<td>Electives (2)</td>
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<table>
<thead>
<tr>
<th>Summer</th>
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<th>Spring</th>
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<tbody>
<tr>
<td>RP 564</td>
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<table>
<thead>
<tr>
<th>Junior Year</th>
<th>Fall</th>
<th>Spring</th>
</tr>
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<tbody>
<tr>
<td>Adm. 517</td>
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</tr>
<tr>
<td>Res. Econ. 508</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Plant. Sci. 565</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>RP 663</td>
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<td></td>
</tr>
<tr>
<td>RP 667</td>
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<tr>
<td>RP 668</td>
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<tr>
<td>Electives (2)</td>
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</table>

<table>
<thead>
<tr>
<th>Senior Year</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pol. Sci. 731</td>
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<td>Pol. Sci. 730</td>
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<td>Civ. Eng. 711</td>
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<td>RP 671</td>
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<tr>
<td>Elective (1)</td>
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</tbody>
</table>

|                | **12**| **12**|
School of Health Studies

Recreation and Leisure Programming

This specialization is designed for planning, conducting, and supervising programs in a variety of settings. Students selecting this option are required to complete 128 credit hours for the degree.

**FRESHMAN YEAR**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psych. 401</td>
<td>Introduction to Psychology</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Soc. 400</td>
<td>Introduction to Sociology</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Biol. 402</td>
<td>Man and His Environment</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>RP 455</td>
<td>Introduction to Recreation and Park Services</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>RP 457</td>
<td>Dynamics of Leadership and Programming</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>RP 454</td>
<td>Organized Camping</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Electives (2)</td>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>University Academic Requirements</strong></td>
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</table>

**FALL** 16  **SPRING** 16

**SOHPOMORE YEAR**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soc. 540</td>
<td>Social Problems</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Pol. Sci. 401</td>
<td>Introduction to Political Science</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Soc. 500</td>
<td>Social Psychology</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Micro. 501</td>
<td>Public Health and Sanitation</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>RP 400</td>
<td>Impact of Leisure in Contemporary Society</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>RP 643</td>
<td>Comparative Environmental Education</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Electives (2)</td>
<td></td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>University Academic Requirements</strong></td>
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</tr>
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</table>

**SUMMER**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>RP 564</td>
<td>Field Work in Recreation and Park Services</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

**JUNIOR YEAR**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soc. 530</td>
<td>Race and Ethnic Relations</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Psych. 575</td>
<td>Development of the Normal and Exceptional Child</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Res. Econ. 507</td>
<td>Introduction to Community Problems</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>RP 663</td>
<td>Recreation and Park Administration</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>RP 560</td>
<td>Introduction to College Union and Campus Recreation Services</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Electives (3)</td>
<td></td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td><strong>University Academic Requirements</strong></td>
<td>16</td>
<td>16</td>
</tr>
</tbody>
</table>

**SENIOR YEAR**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soc. 560</td>
<td>Rural-Urban Sociology</td>
<td>4</td>
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</tr>
<tr>
<td>Soc. 629</td>
<td>Small Groups</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Psych. 589</td>
<td>Special Topics</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>RP 644</td>
<td>Outdoor Education</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>RP 698</td>
<td>Seminar in Leisure Problems, Trends, and Research</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Electives (1)</td>
<td></td>
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**UNIVERSITY Academic Requirements**

12 12


Park Management

This specialization is concerned with economics, planning, and supervision including the identification, acquisition and allocation, development, and maintenance of land and water resources for recreational purposes. Students selecting this option are required to complete 128 credit hours for the degree and are allowed very little flexibility in course electives.

<table>
<thead>
<tr>
<th>FRESHMAN YEAR</th>
<th>FALL</th>
<th>SPRING</th>
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<tbody>
<tr>
<td>Biol. 402</td>
<td>Man and His Environment</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 401-402</td>
<td>General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>RP 455</td>
<td>Intro. to Recreation and Park Services</td>
<td>4</td>
</tr>
<tr>
<td>Res. Econ. 401</td>
<td>Macro- and Environmental Economics</td>
<td>4</td>
</tr>
<tr>
<td>RP 661</td>
<td>Recreation Resources Management</td>
<td>4</td>
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<tr>
<td>Elective (1)</td>
<td>University Academic Requirements</td>
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<tr>
<th>SOPHOMORE YEAR</th>
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<tbody>
<tr>
<td>Micro. 501</td>
<td>Public Health and Sanitation</td>
<td>4</td>
</tr>
<tr>
<td>Plant Sci. 421</td>
<td>Concepts of Plant Growth</td>
<td>4</td>
</tr>
<tr>
<td>Civ. Eng. 501</td>
<td>Surveying</td>
<td>4</td>
</tr>
<tr>
<td>Plant Sci. 427</td>
<td>Landscaping the Home Grounds</td>
<td>4</td>
</tr>
<tr>
<td>H.A. 509</td>
<td>Financial Analysis and Controls</td>
<td>4</td>
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<td>Electives (3)</td>
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<th>SUMMER</th>
<th>FALL</th>
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<tbody>
<tr>
<td>RP 564</td>
<td>Field Work in Recreation and Park Services</td>
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<tr>
<th>JUNIOR YEAR</th>
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<th>SPRING</th>
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<tbody>
<tr>
<td>Plant Sci. 565</td>
<td>Recreational Turf</td>
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<tr>
<td>S&amp;W Sci. 709</td>
<td>Soil and Community Planning</td>
<td>2</td>
</tr>
<tr>
<td>RP 663</td>
<td>Recreation and Park Administration</td>
<td>4</td>
</tr>
<tr>
<td>RP 667</td>
<td>Recreation Resource Planning</td>
<td>4</td>
</tr>
<tr>
<td>RP 668</td>
<td>Designing and Engineering Facilities and Areas for Recreation</td>
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</tr>
<tr>
<td>Res. Econ. 676</td>
<td>Economics of Water Use and Quality Management</td>
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<td>Electives (2)</td>
<td>University Academic Requirements</td>
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<tbody>
<tr>
<td>H.A. 655</td>
<td>Management for Transient, Leisure and Indigent Services</td>
<td>4</td>
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<tr>
<td>For. Res. 797</td>
<td>Forest Recreation Seminar</td>
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<tr>
<td>Res. Econ. 795, 796</td>
<td>Investigations in Resource Economics</td>
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<tr>
<td>Res. Econ. 706</td>
<td>Economics of Resource Development</td>
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<tr>
<td>RP 671</td>
<td>Legal and Financial Aspects of Leisure Services</td>
<td>4</td>
</tr>
<tr>
<td>RP 698</td>
<td>Seminar in Leisure Problems, Trends, and Research</td>
<td>4</td>
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<tr>
<td>Electives (2)</td>
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<td>8</td>
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Office of University Recreation Services

The Office of University Recreation Services provides opportunities for students, faculty, and staff to engage in a variety of recreational activities on a regularly scheduled basis.

The office encourages everyone in the UNH community to develop leisure-time interests and to take advantage of opportunities for fellowship with other students, faculty, and staff. The recreational service program is organized basically into three interrelated systems:

1) the Recreation Sports Program: men's and women's intramurals, co-recreational activities, and faculty/staff recreational sports;

2) the Club Sports Program: interest groups and club-sport teams reflecting the recreational and cultural preference of members of the campus community; and

3) the Open Recreation and Leisure Time Activities Program: making facilities available to students, faculty, and staff for informal play and recreational activities.
Whittemore School of Business and Economics

Jan E. Clee, Dean
Lawrence P. Cole, Assistant Dean
John R. Haskell, Assistant Dean
Thomas McCarron, Assistant to the Dean
Jeannette Rozene, Undergraduate Counselor

Program Directors

ADMINISTRATION:
   Donald Marschner, Professor

ECONOMICS:
   William Hosek, Associate Professor

HOTEL ADMINISTRATION:
   Mel Sandler, Associate Professor

Programs of Study

BACHELOR OF ARTS:
   Economics

BACHELOR OF SCIENCE:
   Administration
   Hotel Administration
General Information

The Whittemore School of Business and Economics was established as a separate degree-granting school July 1, 1962.

The basic purpose of the School in its undergraduate curricula is to combine the breadth of liberal education with the depth of professional training in administration, economics, and hotel administration. Undergraduate students enrolled in Whittemore School programs are required to take a substantial part of their course work in other colleges of the University. In particular, students will be encouraged to elect courses in the social sciences, mathematics, the natural sciences, the arts, and the humanities. The student who completes the program in administration or economics will find that he is prepared for advanced study at the graduate level in these and related disciplines.

Another purpose of the School is to serve the needs of other undergraduate students in the University for whom selected courses in administration, economics, and hotel administration are essential or desirable for the completion of their various curricula. Hence, most Whittemore School courses are open to non-majors who have the necessary background.

Requirements for Degrees

The Whittemore School offers the degrees of Bachelor of Arts and Bachelor of Science. Students concentrating in economics will be candidates for the Bachelor of Arts degree, and students concentrating in the other curricula will be candidates for the degree of Bachelor of Science. Each candidate for a degree must satisfy the general education requirements and all other University requirements for graduation, and achieve a minimum grade-point average in the prescribed program curriculum.

The several curricula in the Whittemore School are subject to revision and modification from year to year. Students are subject to and responsible for such changes as they may be introduced. Entering students may anticipate, however, that a curriculum as presented, or as subsequently modified, will permit their graduation in four years, assuming that normal academic loads are carried and normal progress is made.

An undergraduate student entering the school will be required to declare a major not later than the end of the sophomore year. The new catalog becomes effective on July 1 of each year. For information concerning advanced degrees, see the Graduate School catalog.

Advising System

Undergraduate advising in the Whittemore School is two-tiered. An Undergraduate Counselor is available in the Dean’s office to assist students with administrative matters, questions concerning academic stand-
ards and requirements, etc., and for counseling of a general academic nature. The faculty are available for course, program, and career counseling according to their own experience, expertise, and interests. In that connection, students are provided with a faculty profiles booklet which contains relevant information about each faculty member’s professional background and current scholarly pursuits. This is intended to enable students and faculty to develop an advisory relationship according to their mutual interests. While faculty signatures are still required on some documents, most form-signing is done in the office of the Undergraduate Counselor.

Independent Study

A junior or senior student in the Whittemore School of Business and Economics may elect the opportunity for independent study. The credits allowed range from four semester hours for juniors to 12 semester hours for seniors. To be eligible, a student must ordinarily submit, prior to registration, a plan for independent study that has the approval of the adviser and the instructor involved to the Whittemore School Executive Committee for its information. The student pursuing an independent-study program must meet all general Whittemore School requirements. The student may petition to substitute independent-study credits in whole or in part for required-course credits in the economics curriculum or for elective credits in the hotel administration curriculum.

The student taking an independent study program will arrange for a member of the faculty in the area of interest to be the supervisor. It is expected that the program will normally take the form of an independent research paper, although programs calling for another form will be considered.

Minor Program

A minor is not required in the economics, administration, and hotel administration curricula. A student in any one of three curricula may, however, apply for permission to pursue a minor program of study in any discipline in which sufficient courses are offered at the University. Permission to participate in a minor program may be granted only by the Executive Committee of the Whittemore School with the concurrence of the particular department involved. Consideration shall be given to the student’s major area of concentration and proposed minor before granting such permission. Successful completion of such a program is recorded on a student’s academic transcript.

A minor shall comprise at least 20 semester hours with grades of C or better in courses which count for major credit in the department in which the minor is to be earned. No more than eight credits used to satisfy University general education requirements shall be used for a
minor. Courses counting toward a minor may not be taken on a Pass/ Fail basis.

Student Designed Major

See page 125 for requirements for student designed major.

Dual Major Option

A student may petition to earn two majors in any disciplines awarding the Bachelor of Arts degree. No more than eight credits used to satisfy requirements for one major may be used for the other. A student should declare the intent to earn two majors as early as possible and no later than the end of the junior year, and should plan the program in consultation with advisers from both majors.

Dual Degree Programs

A student may obtain more than one undergraduate degree by completing all the curriculum, departmental, college, scholastic, and other requirements. Anyone interested in such a program of study should confer with the deans of the colleges in which the degrees are to be earned as early in an academic career as possible and, if approved for the program, should expect to work closely with faculty advisers from the college involved. See page 24 for requirements.

Administration Program

The Administration Program trains young men and women for managerial or administrative careers in business or in public or semi-private institutions.

Since most graduates of the Program elect to embark upon business careers, the major thrust is in that direction. However, as demand has grown in recent years for people able to apply businesslike methods to the problems of nonprofit institutions, such as hospitals, school systems, government departments, and other socially-oriented organizations, the Program’s objectives have been broadened considerably to include all types of administration, rather than business only.

The curriculum offers professional education in the basic theories, principles, concepts, and analytical tools used by successful modern administrators, combining them with an introduction to some of the important functional areas of management. At the same time, the typical student achieves a well-rounded education by selecting courses in the liberal arts and the sciences from other colleges and schools in the University.
All students enrolled in the program must complete a five-course core of basic administrative tools and skills. Most students will then go on to take three prescribed courses in functional areas and two elective courses from administration or economics. Some students, however, will be permitted to fulfill the requirements of the program by building on to the core another cohesive package of five courses which suit the individual’s needs and which may include only one or none of the functional area courses. Such a proposal needs the approval of the Administration Program Director. In either case, a student must achieve a grade-point average of at least 2.0 in the program in order to graduate.

Students not majoring in administration are encouraged to consider courses in accounting, organizational behavior, finance, marketing, production, etc. as relevant supplements to their own program of study. Advice concerning courses appropriate to various career goals may be obtained from members of the Administration faculty.

A suggested plan of study is given below:

**FRESHMAN AND SOPHOMORE YEARS**
- Economics 402, Principles of Economics (Micro)
- Administration 411, Behavior in Organizations
- Administration 424, Quantitative Analysis
- Administration 502, Financial Accounting

**JUNIOR AND SENIOR YEARS**
- Administration 650, Operations Management
- Administration 651, Marketing
- Administration 653, Financial Management
- Administration and/or Economics electives (2)

**SEMESTER II—SENIOR YEAR**
- Administration 700, Management Policy

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**Economics**

Economics is the study of the allocation of scarce resources among competing uses. Such allocation may be accomplished by conscious public policy or by impersonal market forces. Among other things, economic analysis enables the policymaker to select the most efficient method of allocation consistent with the goals of society. The purpose of the Economics program is to introduce the student to the tools of economic analysis with application to a variety of areas and problems.

Undergraduate training in economics does not qualify a student as a professional economist, so those students who intend to become economists should plan on doing graduate work in the discipline. Nevertheless, undergraduate training in economics does provide an excellent
background for graduate work not only in economics but in related disciplines, such as business administration, political science, and law and for employment in business and government service.

Students planning to pursue graduate study in economics should consult with their advisers early in their academic program. This consultation should facilitate entrance into graduate school.

Courses in the Economics program are open to non-majors. Students in other disciplines may find certain economics courses useful complements to their own programs. Political science majors, for example, may be interested in Economic Development, Comparative Study of Economic Systems, Public Finance, and Government Regulation of Business. Technology students should find Statistical Theory, Introduction to Econometrics, and Statistical Decision Making beneficial in their own career preparation. Non-economics majors with questions about the nature of various courses should feel free to seek answers from members of the Economics faculty. Economics majors must complete seven full courses in economics with a grade point average of 2.0 or better. Moreover, the intermediate theory courses at the core of the program, namely Economics 605 and 611, must be passed with at least a grade of "C." Major credit towards Economics 605 and/or 611 will be awarded transfer students only if such courses have been taken at the junior level or above. (Transfer students must take five of their seven economics courses at UNH.) All Economics majors must satisfy the foreign language proficiency requirements established by the College of Liberal Arts for all Bachelor of Arts candidates.

A suggested plan of study for the economics major is given below:

**FRESHMAN AND SOPHOMORE YEAR**
- Economics 401, 402, Principles of Economics
- Mathematics 415, Mathematics for Business and Economics
- Economics 525, Introduction to Economic Statistics

**JUNIOR YEAR**
- Economics 605, Intermediate Economic Analysis
- Economics 611, National Income Analysis

**SENIOR YEAR**
- Economics electives (2)

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**Hotel Administration**

The objective of the Hotel Administration program is to prepare students to perform in managerial-level jobs in enterprises and institutions of the services sector of the economy which have major food service and lodging components.
The services sector includes lodging, food service, tourism and recreation industries, and institutions such as hospitals and schools.

In addition to the general education requirements of the University, students receive an extensive foundation in administration and economics. The Hotel Administration courses complement coursework in these areas to provide the specialized knowledge needed for effective performance as managers.

Experience in and exposure to the services industry is provided by the following requirements:

1. One summer, or the equivalent, of approved on-the-job experience. A variety of work is desirable which should include experience in quantity food preparation.

2. Projects and work-observation periods in operations as an integral part of the courses in Lodging and Food Service and Institutional Management, Management of Physical Structures, and Markets and Promotion of Public Services.

3. Planning, marketing, preparation, and service of large-scale gourmet dinners as part of the course Functional Management.

4. Attendance at a series of lectures by representatives of service-sector businesses and institutions.

Students in the hotel administration program must obtain a grade point average of 2.0 or better in the required courses given in the Whittemore School. A graduate of this program, who is qualified for and interested in further allied studies, is well prepared for advanced degree programs in business or institutional administration.

A suggested plan of study is given below:

**FRESHMAN YEAR**
Hotel Administration 403, Elements of Institutional Administration  
Administration 411, Behavior in Organizations  
Economics 402, Principles of Economics (Micro)

**SOPHOMORE YEAR**
Administration 424, Quantitative Analysis  
Administration 517, Survey of Managerial Accounting  
Hotel Administration 518, Financial Analysis and Control  
Hotel Administration 556, Management of Physical Structures

**JUNIOR YEAR**
Administration 651, Marketing  
Hotel Administration 655, Lodging, Food Service & Institutional Management  
Hotel Administration 666, Markets & Promotion of Public Service

**SENIOR YEAR**
Hotel Administration 667, Functional Management
The Graduate School

H. Trevor Colburn, Dean
William H. Drew, Associate Dean
Kenneth O. Freer, Assistant to the Dean

Master of Science
Animal Sciences
Biochemistry
Biology
Botany and Plant Pathology
Chemical Engineering
Chemistry
Civil Engineering
Earth Sciences
Electrical Engineering
Entomology
Forest Resources
Genetics
Home Economics
Mathematics
Mechanical Engineering
Microbiology
Music Education
Physical Education
Physics
Plant Science
Resource Economics
Soil and Water Science
Zoology

Master of Arts
Economics
English
French
German
History
Music
Political Science
Psychology
Sociology
Spanish

Master of Arts in Teaching
Department of Education

Master of Science for Teachers
Chemistry
English
French
Mathematics
Physics
Spanish

Master of Occupational Education
Department of Occupational Education

Master of Business Administration
Whittemore School of Business and Economics

Master of Education
Department of Education

Master of Public Administration
Department of Political Science

Doctor of Philosophy
Biochemistry
Botany and Plant Pathology
Chemistry
Economics
Engineering
English
Genetics
History
Mathematics
Mathematics Education
Microbiology
Physics
Plant Science
Psychology
Sociology
Zoology
Graduate School

The Graduate School offers a wide range of programs leading to the master's degree and a smaller number of programs leading to the Ph.D. degree. Graduate programs have been developed gradually and systematically with the goal of achieving academic excellence by careful utilization of institutional resources and regional opportunities. A highly qualified graduate faculty supervises graduate programs and establishes the requirements for admission and degrees which are administered by the Deans of the Graduate School.

Most graduate programs are relatively small and permit the student the opportunity to work closely with the faculty in his area of specialization. The aim of the graduate programs is to offer high level professional training in their respective disciplines and to provide opportunities for students to learn and practice sound research methods. Graduate students are expected to utilize fully the available opportunities and to demonstrate the maturity and self discipline necessary for sound scholarship.

A number of programs and facilities such as the Genetics Programs, Jackson Estuarine Laboratory, Ritzman Animal Nutrition Laboratory, Center for Industrial and Institutional Development, The Space Science Center, Resource Development Center, Water Resources Research Center, Engineering Design and Analysis Laboratory, Bureau of Educational Research and Testing, and Public Administration Service, provide opportunities to engage in interdisciplinary research.

Admission to the Graduate School may be granted to graduates of colleges and universities of approved standing, provided that the applicant's undergraduate record is satisfactory. An applicant's race, religion, color, national origin, or sex are not considered in the admissions process. The official application for admission and the Graduate Catalog containing detailed descriptions of graduate programs may be obtained from the Dean of the Graduate School, Social Science Center, University of New Hampshire, Durham, New Hampshire 03824.

Financial Aid

Graduate Assistantships are available in most departments. These involve part-time work in connection with the University's instructional activities, University sponsored awards, such as tuition scholarships, UNH Fellowships, and Martin Luther King awards, and Dissertation Fellowships, are available to qualified students. A number of fellowship programs sponsored by such outside agencies as the National Science Foundation, Department of Health Education and Welfare, U. S. Office of Education, and the U. S. Public Health Service may be available.
Division of Continuing Education

Edward J. Durnall, Director

The Division of Continuing Education seeks to meet the educational needs of adults and part-time students through programs which range from one-day educational conferences to organized sequences of credit courses leading to UNH associate, baccalaureate, and master’s degrees. In addition to programs listed below, it is possible through enrollment in courses scheduled by the Division to complete many of the degree requirements in other areas of study offered by the University.

Degree Programs

Associate in Arts

The associate degree program gives the adult, part-time student an opportunity to obtain a broad, general education or to supplement a general education with courses in an elected career option. The general education is provided by 12 credit-hours each in the social sciences, natural sciences, and humanities. The remaining coursework is elected by the student.

Students may elect the option in General Studies by taking the final 28 credits in liberal arts subjects of personal interest. Or the student may elect to complete his course work in one of the available career options—Banking, Merchandising, Real Estate, Insurance, Management, Health Care Administration, Library Science, Accounting, and Secretarial Studies. The student may also design his own career option in General Studies by taking particular course work to meet personal or vocational goals.

Students receiving an Associate in Arts degree from the Division of Continuing Education, the Merrimack Valley Branch, and the School of Continuing Studies will be awarded 64 semester hours of credit upon entry into a baccalaureate degree program at the University of New Hampshire in Durham.
General Information

Bachelor of Arts—History

History as a major field of study may be of interest to: the prospective teacher; those planning on professional study in areas such as law, library science, and diplomacy; and those who wish a well-rounded, liberal-arts education.

Bachelor of Arts—Social Service

The major in Social Service is designed for students who wish to prepare for careers in human services and the program is approved by the Council on Social Work Education for constituent membership. Graduates normally enter employment in the field of Social Welfare or continue their studies in graduate schools.

Master of Education—in Administration and Supervision, Counseling and Personnel Services, Elementary Education, Reading, and Secondary Education

These graduate programs are designed to prepare students for careers in education and to further the professional growth of in-service teachers.

General Information

Admission Requirements

The requirements for admission to the above programs are appropriate to the level of study and are fully described in the Bulletin of the Division. Enrollment in courses at the Associate and Bachelor's level is open to individuals who are either high school graduates or are eighteen years of age or older. Graduate-level courses are open to individuals holding a bachelor's degree or its equivalent.

Time Required

The length of time required to complete any of the above degree programs will depend upon the amount of time the individual is able to devote to his studies and the amount of credits that the individual may have earned by: prior college study, examinations under the College Level Examination Program, Service experience, USAFI courses, and specialized courses offered by the Armed Forces or civilian institutions. The student entering without any credits which may be applied toward the degree should be able to complete the Associate degree in three to four years of part-time study, the Bachelor's degree in six to eight years and the Master's degree in two years.
Course Charges and Academic Year Class Schedule

Course charges vary within the Division; further information may be obtained from the Division office. Students taking regular UNH day courses and courses in the Division of Continuing Education and/or at the Merrimack Valley Branch should be aware that the combined total of credits for which the student is registered will be used in determining liability for full tuition. Please see page 17.

Courses offered by the Division are scheduled to meet the needs of part-time students. While most classes are held in the late afternoon and evening during the fall and spring semesters, a limited number of courses are available during the day. The academic calendar for Division varies somewhat from the regular University calendar.

Summer Session

The Division offers the student the opportunity to continue his studies on a year-round basis through two eight-week and three four-week summer terms. Classes are scheduled in the morning, afternoon, and evening to meet the needs of the wide range of students registering for summer courses. A separate Summer bulletin is published in March and is available upon request.

Further Information

Individuals interested in the programs of the Division may obtain a bulletin of the Division by writing to:

Director of Division of Continuing Education, 203 Huddleston Hall, University of New Hampshire, Durham, New Hampshire 03824. Telephone (603) 862-2015.
Pre-Professional, Interdisciplinary, and Experimental Programs

The Teaching/Learning Council established by the University Senate with financial support from the Danforth Foundation is charged with encouragement of excellence and innovation in undergraduate teaching. To this end, the Council is exploring many approaches—colloquia, video-tape equipment, teaching awards, and so on—which may lead to improvement in teaching. In cooperation with the Committee on Educational Innovation in each of the University's colleges, the Council supports faculty members in the development of new approaches to teaching in existing or new courses. The Council also fosters and promotes the development of experimental and interdisciplinary courses and programs by faculty members and other qualified persons. In the spring semester of 1973, courses sponsored by the Council include: Introduction to Film Study, Current Issues Facing Christianity, Developing Nations: Our Values and Theirs, Individuals and Communities. Some past offerings have included, Poverty in America, Women in American Society, The Effects of Technology on Society.

Courses under Council sponsorship are normally offered for one semester, though some have been repeated. The Independent Work Study course described below is a continuing offering.

Independent Work-Study, Inter-College 598. This course is primarily for students who want to pursue a semester of off-campus study. The student selects the problem area in which he wishes to work, creates his own bibliography for reflection, and finds his own channels to actively pursue the problem. The student must write a proposal identifying the manner in which he intends to pursue the study and then obtain the sponsorship of a faculty member. The proposal should be submitted to the Teaching/Learning Council. 4 to 16 credits.

The Student Designed Major

Under special circumstances a student may design his own major. This option is offered in response to the highly motivated and independently disciplined student who wishes a course of study which is not available through existing programs at the University. It allows the student, with the close supervision of a faculty member, to cross
Interdisciplinary and Experimental Programs

department and college lines, and to create individual educational experiences on and off campus as part of his program.

The program is administered by a committee of elected faculty which operates through the Office of the Vice Provost for Academic Affairs. Students who want to design their own major are expected to give the committee evidence of careful thought and planning in a detailed proposal. Guidelines for this proposal are available in the Office of the Vice Provost for Academic Affairs.

Pre-Law

While the various bar associations and law schools do not prescribe a specific undergraduate curriculum for future lawyers, they recommend that a student who contemplates entering law school should plan a study program which will develop breadth of view and facility of expression. They also urge him to acquire a background of information concerning the society in which he lives and the forces which have shaped modern institutions. They urge him particularly to perfect his use and understanding of the English language in writing and speaking.

The most helpful courses are those which develop oral and written expression; deal with man’s social, economic, and political institutions; provide an understanding of the human mind; and develop the art of thinking. A course in the elements of accounting may be useful.

Law Schools generally require the Law School Admission Test of students seeking admission, and where required it is most advisable that this be taken in the senior year. Each law school will advise a student upon request whether or not he will be expected to take the test in partial satisfaction of admission requirements. Particulars of the examination may be obtained at the office of the Chairman of the Political Science Department.

Students who plan to enter law school after graduation are advised to consult with the Chairman’s office of the Department of Political Science as soon as they have made their decision, preferably in the sophomore year.

Premedical-predental Program

Students considering a career in medicine or dentistry should become familiar with the minimum course requirements as early as possible, so that specific courses needed for application to medical and dental schools can be incorporated into their programs. The premedical-predental option is not a major with a rigidly prescribed curriculum; rather, it is the acknowledgment of a student’s professional intention. Although a majority of students in the past have elected zoology as a major, there is a trend, particularly in premedicine, away from exclusive concentration in a single area of science. In recent years students from UNH have chosen to major not only in sciences such as
zoology, microbiology, biochemistry, and chemistry but also in such fields as history, English, psychology, and political science.

Each student will choose a major subject based on his own interests and aptitude and will be assigned an appropriate faculty adviser from that department or school. The responsibility of the Premedical-Predental Advisory Committee is to offer information about medical and dental admission requirements and procedures and to provide recommendations at the time of application.

All medical and dental schools expect applicants to have demonstrated ability in basic natural and physical sciences. Although the specific requirements for admission vary considerably, the following courses constitute a minimum in order that a student may be considered for admission: biological sciences, physics, general chemistry, and organic chemistry; all two semesters each with laboratory; and mathematics through calculus. Proficiency in English and a foreign language is strongly recommended. An appropriate group of courses from among the offerings at the University of New Hampshire would be the following: Zoology 412, 518; Physics 401-402 (or 407-408); Chemistry 403-404 and 651-652; and Mathematics 427, 428. Some dental schools require a semester of quantitative analysis (Chemistry 517) and are less demanding about a mathematics requirement.

Courses which qualify an individual for consideration as a premedical or predental student should be completed by the time the application to a professional school is submitted. Inasmuch as the performance in these courses is weighted heavily by the admissions committees, it is strongly recommended that students not register for them under the pass-fail option.

Interested students should enroll with the chairman of the Premedical-Predental Advisory Committee as early as possible.

Genetics

An undergraduate degree in Genetics is not offered at the University of New Hampshire. In the Graduate School, the M.S. and Ph.D. degrees are offered in an Interdepartmental Genetics Program. For courses offered in the Program, some of which may be taken by the undergraduate, refer to the Graduate Catalog. Undergraduates interested in preparing for graduate work in Genetics at UNH or elsewhere should contact the Chairman of the Genetics Program early in their undergraduate program for advice on courses which will aid in this preparation.

Minor in International and Geographic Area Studies

This minor is being planned by the International Studies Council; it consists of 5 courses (20 credits). A student takes three of these courses with reference to one of the following geographic areas: 1) Asia, 2) West Europe, 3) Soviet and East Europe, 4) Africa and the
Interdisciplinary and Experimental Programs

Middle East, 5) Canada, or 6) Latin America. The other two courses are ones that cut across all areas. The International Studies Council maintains a list of interdepartmental and interdisciplinary courses for this minor.

Students who spend a junior year abroad (in Dijon, Salzburg, or Valencia) may arrange to have relevant overseas courses counted towards this minor.

Please check with the International Studies Council for further plans and details.

Computer Courses

The University has an IBM 360/50 computer with a number of teletype terminals located around the campus. Many science and engineering courses involve assignments which the student is expected to work out on the computer.

The Electrical Engineering Department offers courses in computer design and the Mathematics Department offers courses in programming and numerical analysis. There is an interdisciplinary major in Mathematics-Computer Science described on page 91 of this catalog.

Marine Science and Technology

The University has a history of interest and activity in marine science dating from the 1930's. Marine interest has recently been intensified and broadened to include ocean engineering.

The nearby salt water of the ocean, together with the waters of the Great Bay estuary system, form a natural and versatile setting for research in geology, the life sciences, and engineering. The new Jackson Estuarine Laboratory serves as a center for the marine science program and estuarine and other marine research. The research vessel, "Jere A. Chase," is used for research in the estuary and nearby ocean. Plans are being made, through arrangements with state and other agencies, to develop marine educational facilities on the Atlantic shore and at the Isles of Shoals which are ten miles off the coast.

Marine Science

Students wishing to prepare themselves for careers in marine science should enroll in one of the standard science disciplines. They should consider the following courses which are available to undergraduates: (1) In Botany—Introduction to Phytoplankton Ecology and Marine Botany, and Marine Algology Ecology; (2) In Earth Sciences—Introduction to Oceanography, Geological Oceanography, Physical Oceanography, Mineralogy of Clays, Principles of Geochemistry, Chemical Oceanography, Sedimentation-Stratigraphy, Estuarine and Marine Sedimentation, Exploration Geophysics; (3) In Microbiology—Public
Interdisciplinary and Experimental Programs

Health and Sanitation, General Microbiology, Environmental Microbiology, and Marine Microbiology; and (4) In Zoology—Biological Oceanography, Principles of Ecology, Comparative Endocrinology, Natural History of Cold-blooded Vertebrates, Marine Ecology, Invertebrate Zoology, Protozoology, the Host-parasite Relationship, Comparative Physiology, and Invertebrate Embryology.

Cooperative Educational Programs in Marine Science

Two cooperative programs in marine science are offered entitled "An Introduction to Marine Science."

One program is a cooperative summer offering with Cornell University and the State University of New York. It is a general introduction to marine science, aimed primarily at undergraduates, drawing on the professional backgrounds of more than twenty-five faculty and nearly as many, captains, fishermen, and others whose living is associated with the sea. Credit has been four hours. Prerequisite: at least a full year of college biology. Daily lectures, laboratory, and field work are taught on the Isles of Shoals or in Durham. No formal examinations; grades are P or F; (pass or fail). The program meets in June, July, and August. Zoology 774: Introduction to Marine Science, 4 credits. For further information please contact Dr. John Kingsbury, Cornell University, Room 204, Plant Science Building, Ithaca, N.Y. 14850.

The second program is a multidisciplinary, team-taught course under the auspices of The New Hampshire College and University Council. Topics and units include: physical, geological, and chemical oceanography; biological oceanography and plankton; marine algology; marine invertebrates; and field trips. Prerequisite: approval of the campus representative of the Marine Science Committee of The New Hampshire College and University Council. Fall and spring semester courses, as well as summer courses. 4 credit hours. The course meets on Saturdays only. Summer Course, 4 or 8 credits.

The campus representative for both these courses is Dr. Theodore Loder.

Ocean Engineering

Study and research in the application of engineering to ocean exploration and exploitation are centered in the Engineering Design and Analysis Laboratory (EDAL). EDAL is an interdisciplinary faculty group, mainly from the College of Technology. Early in its history, this group chose to make ocean-oriented engineering its principal, but not exclusive, interest. The stated purpose of EDAL is to involve both faculty and students in realistic and challenging engineering projects. In projects, thus far accomplished, EDAL-associated faculty and students have participated in advanced ocean-oriented engineering.
An Ocean Engineering Minor Program is available to undergraduate students. Students who elect this program are given suitable recognition on their transcripts. Additionally, undergraduates who wish to become more intensely involved in ocean engineering activities, may do so by associating themselves with professors and graduate students who are engaged in ocean projects.

Information on the Ocean Engineering Minor Program is given on page 76 of this catalog.
Description of Courses

IBM Key Codes

The following numbers are used extensively in machine-processed data to identify both undergraduate and graduate programs offered at the University. An asterisk preceding the number identifies those departments which offer graduate programs.

College of Liberal Arts
58 Liberal Arts non-departmental
59 The Arts
60 Biology
*61 Education
*62 English
*63 French
64 Italian
65 Geography
*66 German
67 Russian
*68 History
69 Humanities
*70 Microbiology
*71 Music
*72 Music Education
73 Philosophy
74 Physical Science
*75 Political Science
*76 Psychology
*77 Spanish
78 Classics
79 Greek
80 Latin
81 Social Science
*82 Sociology and Anthropology
83 Speech and Drama
*84 Zoology

College of Life Sciences and Agriculture
*17 Animal Science
*18 Biochemistry
*19 Botany and Plant Pathology
*20 Entomology
*21 Forest Resources (INER)†
*22 Home Economics
*23 Occupational Education
*24 Plant Science
*25 Resource Economics (INER)†
*26 Soil and Water Science (INER)†
27 Inst. of Nat. & Envir. Resources

† INER—Institute of Natural and Environmental Resources

College of Technology
45 Technology non-departmental
*46 Chemical Engineering
*47 Chemistry
*48 Civil Engineering
*49 Earth Science
*50 Electrical Engineering
*51 Mathematics
*52 Mechanical Engineering
*53 Physics
*54 Ph.D. Engineering

Whittemore School of Business and Economics
*30 Administration
*31 Economics
32 Hotel Administration
33 Secretarial Studies

Separate Departments and Programs
96 Intercollege
*97 Genetics Program
98 Military Science
99 Aerospace Studies

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Description of Courses

Explanation of Arrangement

The title and the Arabic numeral designate the particular course. Odd numerals indicate courses normally offered in the first semester; even numerals indicate courses normally offered in the second semester. The course description is followed by the prerequisites, if any, and the number of semester credits the course will count in the total required for graduation. Laboratory periods are usually two and one-half hours in length, lectures either 50 minutes or 80 minutes in length.

NLG following the description indicates that the course carries no letter grade, being marked “Cr” for credit, “F” for failure. All courses (unless otherwise marked) are open to students who have passed the prerequisites. An elective course may be given only when there is a minimum of five students registered.

If the course numerals are connected by a hyphen, the first semester, or its equivalent, is a prerequisite to the second semester. If the numerals are separated by a comma, properly qualified students may take the second semester without having had the first.

Students must register for the number of credits or within the range of credits shown in the catalog description of a course.

The system of numeric designation of courses is as follows:
200–299 Courses in the Thompson School of Applied Science.
300–399 Non-credit courses, e.g., Mathematics 301.
400–499 Introductory courses not carrying prerequisites and courses generally falling within University and college requirements.
500–599 Intermediate-level courses for undergraduate credit only.
600–699 Advanced-level undergraduate courses. Entrance to courses numbered 600 and above normally requires junior standing. (Under some conditions these courses may be taken for graduate credit by non-majors only.)
700–799 Advanced-level undergraduate courses. (These courses may be taken for graduate credit.)
800–899 Courses which carry graduate credit only. (Descriptions will be found in the Graduate School catalog.)
Administration (30)
Program Director: Donald C. Marschner

Professors: Arthur W. Johnson, emeritus; Robert F. Barlow, Jan E. Clee, John A. Beckett, Carroll M. Degler, Stephen L. Fink, Herman Gadon, John Korbel, Dwight R. Ladd, Donald C. Marschner, Samuel R. Reid

Associate Professors: Allan Braff, Allen R. Cohen, James O. Horrigan, R. Stephen Jenks, William E. Wetzel, Jr., Robin D. Willits, Dwayne Wrightsman

Assistant Professors: John R. Haskell, Richard L. Mills, Linda G. Sprague, John Terninko, Reza Vafa, Visiting

Instructors: J. Patrick Bovino, Donald D. Wells; Patrick Canavan, Visiting

Lecturers: Clyde R. Coolidge, Joseph E. Michael, Jr.

411. Behavior in Organizations
Designed to provide students with exposure to appropriate behavioral science concepts and the opportunity to apply them. Emphasis is on factors influencing an individual's behavior in a small group, on factors influencing small group functioning, and factors influencing the relations between small groups—all in the context of a larger organization. The class is treated as a real organization with attention to roles, norms, rewards, and leadership. Students are expected to take responsibility for the effect of their behavior on their learning environment. Prerequisite: Administration major or permission of instructor. 4 credits.

424. Quantitative Analysis
Elementary survey of quantitative methods for decision making; presentation and summarization of data; probability and inference. Course provides sufficient quantitative background for all other required undergraduate administration courses, but not for upper-division electives in quantitative methods in the Whittemore School. Prerequisite: Successful completion of an entrance examination in high school-level algebra. 4 credits.

502. Financial Accounting
A general introduction to the concepts, procedures, and tools of analysis involved in the selection, qualification, and communication of economic events affecting the financial condition and progress of organizations. 4 credits.

503. Managerial Accounting
General introduction to the concepts, procedures, and tools of analysis employed by managers in gathering and interpreting information for planning and control purposes. Prerequisite: Administration 502. 4 credits.

517. Survey of Managerial Accounting
A general survey of the concepts, conventions, and processes involved in financial accounting and cost accounting. Primary emphasis on the usefulness and limitations of accounting data in decision making and in analyses of past results. For students not majoring in administration. 4 credits.

602. Values in a Managerial Society
A critical examination of the values which appear to underlie our managerial society and of the processes by which such values are formed and modified. For example, such basically eighteenth-century ideas as pursuit of self-interests, desirability of material progress, and individualism are attitudes which have loomed large among our American values. How these ideas relate to our present
managerial society will be discussed, and some emerging alternatives to these long-accepted values will be considered. The course is based primarily on discussions of cases and readings. There are a few lectures. Prerequisite: Administration major or permission of instructor. 4 credits.

614. Organizational Theory
In contrast to Administration 411, this course focuses on the characteristics of the organization. An attempt is made to draw on existing theory to provide the student with a conceptual framework useful in analyzing and administering various types of organizations: e.g. business, educational, medical, and social. Participation in class discussions of cases and written commentary on theoretical readings are required. Occasional field work may be anticipated. Prerequisite: Administration 411 or permission of instructor. 4 credits.

630. Investments
The problems of investment; investment characteristics of stocks and bonds; public utility, railroad, industrial, and government securities; protection of the investor; investment banking; and related problems. Prerequisite: Economics 401-402 and junior standing. 4 credits.

639. The Philosophy of Management Science
A study of management from a systems point of view. 4 credits.

642. Management Information Systems
An orientation in concepts, design, and implementation of management information systems. 4 credits.

647-648. Commercial Law I, II
The law of contracts, agency, sales, negotiable instruments, partnerships, and corporations. Prerequisite: at least junior status and permission of instructor. 4 credits.

650. Operations Management
Principles of production organization, product design, materials acquisition, layout, production engineering, mechanization, production scheduling, and control. Prerequisite: Administration 424 and 502 or permission of instructor. 4 credits.

651. Marketing
A study of the marketing behavior of the firm as it supplies goods and services to consumers and industrial users. Attention is paid to the optimal blending of the ingredients in the "marketing mix," including product design, product line policies, packaging, branding, pricing, promotion, preliminary consumer behavior, and selection of the channels of distribution. Prerequisite: Economics 402 and permission of instructor. 4 credits.

653. Financial Management
A study of the firm's uses and sources of funds with emphasis on working capital management, capital budgeting, and the administration of debt and equity. Prerequisite: Economics 402 and Administration 502 or permission of instructor. 4 credits.

695-696. Independent Study
Individual study projects of special interest and benefit to the student. Permission to pursue an independent study project is required from Undergraduate Counsellor and proposed project instructor. Permission will be granted only to students who have demonstrated unusual individual initiative. 4-12 credits per semester.
700. Business Policy
A capstone, integrative course, interrelating and applying specialized courses; using cases of companies, firms; supplemented by economic and other information from published industry, company, and other sources. Prerequisite: Administration major with senior standing. 4 credits.

705. Operations Research
Mathematical programming, game theory, inventory, queuing, and scheduling problems; dynamic programming. Prerequisite: permission of instructor. 4 credits.

711. Corporations
The role of the modern corporation in the economy. Emphasis upon structure of the corporation, the corporate system, combinations, and concentration. Prerequisite: Economics 401, 402. 4 credits.

712. Organizational Change
Examination of the process of change in organizations. Consideration of change strategies, the role of the change agent, and his relation to the client system. The bases of resistance to change and the problems encountered by internal and external change agents. Readings include theoretical material and cases in areas relevant to organizational change. Prerequisite: permission of instructor. 4 credits.

713. (713). Interpersonal and Group Dynamics
Intensive experiential study of the dynamics of small groups through the use of the class itself as a laboratory study group. Students examine their own behavior and its effects on others through use of the Laboratory Training Group (T-group) as the major learning tool. The course develops both conceptual ability and behavioral skill in this area. Students review readings in group dynamics, interpersonal relations and sensitivity training. Prerequisite: permission of instructor. 4 credits.

717. Advanced Financial Accounting
Accounting theory and practice as they contribute to the significance and limitations of the financial statements by which business communicates financial status to interested outsiders. Prerequisite: permission of instructor. 4 credits.

718. Cost and Management
The effective use of cost accounting, cost analysis, and budgeting in planning and controlling operations. Topics considered include analysis of cost behavior, direct and absorption costing, cost-price-volume relationship, distribution costs, transfer pricing, and capital expenditure analysis. Prerequisite: permission of instructor. 4 credits.

730. Investments Analysis
An evaluation of capital markets and of analytical techniques useful for security appraisal. The following subjects will be covered: securities characteristics, market institutions, yield structures, price change patterns, intrinsic value analysis, investment timing, and portfolio management. Lectures, outside readings, and security analysis research projects are the main tools of the course. Prerequisite: permission of instructor. 4 credits.

732. Explorations in Entrepreneurial Management
The past and probable future role of the entrepreneur in the economic and social development of the U.S. is examined. Emphasis is placed upon differences between entrepreneurial and administrative management. Topics include the
mythology of the "American Dream," the entrepreneur as a change agent, entrepreneurial motivation and behavior patterns, the venture-capital markets, and the role of the entrepreneur in non-profit institutions. Prerequisite: permission of instructor. 4 credits.

741. Transportation Economics
The wide range of problems surrounding the American transportation system. The basic economic structure of the transportation industries with particular emphasis on competition among the several modes. Such public policy questions as merger of transportation enterprises and cost-benefit analysis of transportation facilities are considered. While principal emphasis in the course is on freight transportation, the problems of passenger transportation, especially in urban areas, are discussed. Limited attention is given to distribution as a specific function of business enterprise. Lectures and discussions of cases. Two or three short papers and a term paper are required. Prerequisite: permission of instructor. 4 credits.

747. (747). Federal Taxation
Current federal-income, estate, and gift taxes and their impact on corporations, partnerships, and individuals. Prerequisite: permission of instructor. 4 credits.

750. Marketing Management
The practical application of the theories taught in Administration 651 or 808. Topics covered include the planning, organization, and control of marketing activities in large corporations and in small businesses, with special emphasis on new-product planning and development; laboratory, field, and market testing; pricing policies; selection of channels of distribution; brand management; and the interrelationships between marketing, production, and finance. Principles which underlie sound policy formulation and decision making are established through the analysis of real-life cases, several of which are based on current marketing problems of nearby New Hampshire firms. Prerequisite: a basic marketing course. 4 credits.

751. Advertising and Promotion
How the modern firm employs advertising, personal selling, and other promotional tools to help solve marketing problems with special emphasis on advertising as a medium of communications and as a social-cultural force in the western world. Prerequisite: Administration 651 or permission of instructor. 4 credits.

752. Marketing Research
The search for and analysis of information relevant to the identification and solution of marketing problems. The study of the techniques used in this search—their strengths and limitations—together with the environment in which the search is conducted. The primary aim is to enable one to better understand the problems that arise in this search and to better evaluate the results of such research. Prerequisite: Administration 424 and 651 or their equivalent. 4 credits.

754. Consumer Behavior
The consumer-firm relationship studied in terms of concepts drawn from contemporary social science findings, particularly small group studies. Learning, memory, cognition, motivation, emotion, and perception concepts as related to present and prospective marketing activities of a business organization. Prerequisite: permission of instructor. 4 credits.
755. Advanced Financial Management I
A study of financial policy of the firm with emphasis on solutions to complex problems of capital, leverage, optimal capital structure, capital budgeting, and working capital management. Prerequisite: permission of instructor. 4 credits.

756. Advanced Financial Management II
A study of the long-term financial decisions of the firm, with emphasis on solutions to problems of dividend policy, optimum capital structure, and capital budgeting under conditions of uncertainty and risk. Prerequisite: permission of instructor. 4 credits.

798. Seminar in Administration
Special topics in business administration. This course may be repeated. Prerequisite: consent of adviser and instructor. Credit to be arranged (4 credits maximum).

Animal Sciences (17)
Chairman: Winthrop C. Skoglund

(Animal, Dairy, Poultry, Pre-Veterinary)


ASSOCIATE PROFESSORS: Herbert C. Moore, emeritus; Alan C. Corbett, Thomas P. Fairchild, James B. Holter, James T. O'Connor Jr., Gerald L. Smith

ASSISTANT PROFESSORS: Larry L. Stackhouse, Frank Repka, Gerald Hale

LECTURERS: Janet C. Briggs, Elizabeth C. Smith

400. Animals, Foods, and Man
Historical, biological, economic, social, and political role of animals, and foods derived from them, in the evolution of civilizations and societies composed of man as a biological entity. Open to all students. Mr. S. C. Smith. 3 lectures; 1 laboratory; 4 credits.

401. Introduction to the Animal Sciences
To acquaint the beginning student with the development, economic importance, and problems facing the livestock industry. The commercially important classes of farm animals are discussed with emphasis on dairy cattle, poultry, beef cattle, horses, sheep, and swine. The place of the biological sciences in the rapidly changing animal agriculture is stressed. The course is intended to be the introduction to subsequent specialized courses and gives the student an insight into opportunities in the animal agriculture field. Mr. G. L. Smith and staff. 3 lectures; 1 laboratory; 4 credits.

402 (402). Horsemanship
Instruction in riding using University-owned Morgans under supervision of a riding instructor. A limited number of students may stable their horses at the University. This course can also be taken as an elective in physical education. Three hours of riding per week for which a fee of $35 per quarter is charged. Ms. Briggs. 1 credit.
Animal Sciences

404. Introduction to Light Horse Science
A survey course covering the entire field of light horse science including breeds, feeding, genetics, stable management, diseases, and other practical aspects. Mr. Barney and staff. 3 lectures; 1 laboratory; 4 credits.

501. Animal Anatomy and Physiology
The general anatomy and physiology of domestic animals and birds. Mr. Allen. 3 lectures; 1 laboratory; 4 credits.

502. Fundamentals of Animal Health
The prevention, control, and treatment of the bacterial and parasitic diseases of domestic animals. Mr. Allen. Prerequisite: Animal Sciences 501 or permission of instructor. 3 lectures; 1 laboratory; 4 credits.

503. Abattoir Management
Licensing requirements, sanitation procedures, inspection facilities, and functional use of the slaughterhouse. Field trips to visit operating plants will be taken. Mr. G. L. Smith and Mr. Barney. Permission of instructor is required. 1 lecture; 1 laboratory; 2 credits.

504. Meat and Its Products
Slaughtering, cutting, and identification of beef, lamb, pork, and poultry. Trips are taken to wholesale and retail meat outlets. Mr. G. L. Smith. 3 lectures; 1 laboratory; 4 credits.

506. Principles of Nutrition
A study of the fundamental principles underlying the nutrition of man and animals; the functions of the various nutrients in the maintenance, growth, and production of the animal body and the metabolic disorders resulting from their deficiency; the digestion, absorption, intermediary metabolism, and excretion of individual nutrients will be discussed within this framework. Mr. Repka. 3 lectures; 1 laboratory; 4 credits. (Also offered as Home Economics 506.)

507 (507). The Scientific Approach to Equine Discipline
The physiological development, control, and education—stressing bitting, longeing, and collection. Ms. Briggs. Prerequisite: Animal Science 402 or equivalent and permission of instructor. 1 lecture; 1 laboratory; 2 credits

508. Milk and Its Products
The composition and properties of milk, both chemical and bacteriological. The producing, making, handling, and marketing of milk and its products. 3 lectures; 1 laboratory; 4 credits. (Not offered 1973-74.)

601-602. Animal Selection
601-1 Livestock: Mr. Barney; 602-2 Dairy: Mr. Fairchild; 602-3 Poultry: Mr. Collins. The principles of selection based on production performance, pedigree, and type evaluation. Elective only after consultation with instructor in charge. The student may repeat the course and select any or all of the specialized areas listed above. 1 lecture; 1 laboratory; 2 credits.

603. Applied Animal Nutrition
Application of scientific principles of nutrition to practical feed formulation and feeding systems for poultry and livestock. Mr. G. L. Smith and other staff members. 3 lectures; 1 laboratory; 4 credits.
605. Equine Diseases and Parasites
A study of hygienic practices that relate to the control of many common bacterial, viral, and parasitic diseases of the horse. Mr. O'Connor. 3 lectures; 1 laboratory; 4 credits.

606. Small Animal Diseases
Common disease problems in domestic small animals frequently owned as pets; species include dogs, cats, monkeys, rodents, caged birds, and aquarium fish. Mr. Stackhouse and Mr. Dunlop. 3 lectures; 1 laboratory; 4 credits.

612. Avian Health and Sanitation
A survey of the diseases of domestic fowl. Emphasizes the fundamentals of disease control including bacterial, fungus, helminths, and protozoan parasites; and avian diseases caused by virus entities. Serological tests, virus isolation, and propagation in avian embryos and tissue culture will be conducted in the laboratory. Mr. Corbett and Mr. Strout. 3 lectures; 1 laboratory; 4 credits. (Alternate years; not offered in 1973-74.)

614. Diseases and Parasites of Wildlife
A survey of the diseases and parasites of fishes, birds and game, and fur-bearing animals. Discusses control of diseases as influenced by management practices, the effect of pesticide on wildlife, and the relationship of wildlife diseases to human health. Autopsy techniques, the proper handling of specimens, and the use of state laboratory facilities will be stressed in laboratory. Mr. Strout and other staff members. Permission of instructor necessary. 3 lectures; 1 laboratory; 4 credits.

616. Equine Podology
The structure and function of the appendicular skeleton will be studied with particular emphasis placed upon the conformation of each segment of normal and abnormal limbs. Mr. O'Connor. 3 lectures; 1 laboratory; 4 credits.

617-618. Light Horse Clinic
The theory and practice of bandaging and restraint as used in modern light horse management will be taught. Actual clinical problems in the University herd will be selected for discussion. May be elected for two semesters. Mr. O'Connor. 1 lecture; 1 laboratory; 2 credits.

651-652. Management of the Domestic Animals
651-1 Light Horses: Mr. O'Connor; 651-2 Dairy: Mr. Hale; 652-3 Livestock: Mr. G. L. Smith; 652-4 Poultry: Mr. Skoglund. A study of the economic and management factors involved in the production of the various species of domestic animals. The student can select any or all of the specialized areas listed above. Elective only after consultation with the instructor in charge. 3 lectures; 1 laboratory; 4 credits.

653-654. Principles of Teaching Equitation
The techniques and procedures of teaching equitation. Application of the theories of riding and training with emphasis on dressage instruction. Opportunity will be given to teach riding theory and techniques to college students under the supervision of the head instructor. Must be taken for both semesters. Prerequisite: Animal Science 402, 507, and 651-1. Permission of instructor required. Ms. Briggs. 3 lectures; 1 laboratory; 4 credits.

697 (697). Animal Science Seminar
A survey of recent literature and research in the animal sciences. Staff. 2 credits.
Animal Sciences

701. Physiology of Reproduction
A study of physiology, embryology, endocrinology, reproduction, and lactation in domestic animals. Mr. Strout and Mr. Stackhouse. 3 lectures; 1 laboratory; 4 credits.

702. Physiology of Milk Secretion
A study of the anatomical, physiological, and biochemical aspects of lactation including their interrelationships as they are involved in the normal and abnormal development, maintenance, and functioning of the mammary gland. Consideration will be given to environmental and physiological factors affecting lactation and to the ontogeny and phylogeny of the mammary gland. Staff. 3 lectures; 1 laboratory; 4 credits. (Not offered 1973-74.)

709. Biochemistry of Nutrition
An in-depth study of the intermediary metabolism of nutrients with emphasis on energy metabolism. Coverage includes transport mechanisms, biological oxidations, interrelationships of carbohydrate, fat and protein metabolism in normal and abnormal states, obesity and control of hunger and appetite. Mr. Repka. (Also offered as Home Economics 709.) 3 lectures; 1 laboratory; 4 credits.

710. Ruminant Nutrition
Feeding and management of dairy animals, calf feeding, raising young stock, and feeding for economical milk production. Mr. Holter. 3 lectures; 1 laboratory; 4 credits.

711. Animal Genetics
Mendelian and quantitative inheritance in animals and principles and systems of selection. Prerequisite: 4 credits of genetics or permission of instructor. Mr. Collins. 3 lectures; 1 laboratory; 4 credits.

712. Animal Breeding and Improvement
Principles of population genetics and selection with emphasis on the application of these principles to effect genetic improvement in dairy cattle, livestock, and horses. Prerequisite: Animal Science 711. Mr. Fairchild. 3 lectures; 1 laboratory; 4 credits. (Alternate years; offered 1973-74.)

795-796. Investigations in Dairy, Livestock, Poultry
1. Genetics: Mr. G. L. Smith, Mr Collins, Mr Fairchild.
2. Nutrition: Mr. G. L. Smith, Mr. Ringrose, Mr. Colovos, Mr. Holter, Mr. Hale, Mr. Repka.
3. Management: Mr. G. L. Smith, Mr. Skoglund, Mr. O'Connor.
4. Diseases: Mr. Allen, Mr. Corbett, Mr. Dunlop, Mr. Strout, Mr. S. C. Smith, Mr. Stackhouse, Ms. Wallman.
5. Products: Mr. G. L. Smith.
7. Physiology:
An opportunity is given for the student to select a special problem in any of the fields listed under the guidance of the instructor. Elective only after consultation with the instructor in charge. May be repeated. 2 credits.
Anthropology
(See Sociology and Anthropology)

The Arts (59)
Chairman: Melvin J. Zabarsky

PROFESSORS: John W. Hatch, John Laurent, George R. Thomas
ASSOCIATE PROFESSORS: Sigmund Abeles, Arthur Balderacchi, William Majors, Richard D. Merritt, Winifred Clark Shaw, Daniel L. Valenza, Melvin J. Zabarsky
ASSISTANT PROFESSORS: Conley Harris, John Jagel, Brian T. Jefferson, Jun Kaneko, Peter Moak, Ian Walker
INSTRUCTOR: Morton C. Abromson

Courses in the Departments of The Arts are designed to support all degree programs: B.A., B.F.A., and B.S.

Three-Dimensional Courses

401. Ceramics
A course designed to give a basic understanding of the ceramic media. Includes hand-forming and potter's-wheel techniques. Elective by permission. 1 lecture; 2 laboratories; 4 credits.

413. Jewelry and Metalsmithing
Structural and decorative design and construction of jewelry, flatware, and hollow ware. Soldering, polishing, chasing, casting, raising, forging, fabrication, and enameling metal (sterling silver, copper, brass, pewter) are included. Elective by permission. 2 laboratories; 4 credits.

425. Woodworking
A basic woodworking course that integrates drawing, design, theory, and techniques with construction of projects of the student's own design. Elective by permission. 2 laboratories; 4 credits.

434. Introduction to Three-Dimensional Design
An introductory course for all students planning to concentrate in 3-dimensional design, i.e., sculpture, ceramics, furniture design, and jewelry. Various materials will be explored to discover and develop an understanding of the oneness that occurs when form and material are properly integrated. Elective by permission. 1 4-hour laboratory; 4 credits.

501. Ceramics
Use of the various production techniques as tools for perceptual development with the ceramic media. Technical development of clay bodies and glazes. Prerequisite: Arts 401. Elective by permission. 1 lecture; 2 laboratories; 4 credits.

502. Ceramics
Investigation of specialized areas of ceramics with a major emphasis on perceptual development. Includes various methods of firing and glaze treatment. Research project required. Prerequisite: Arts 401. Elective by permission. 1 lecture; 2 laboratories; 4 credits.

513, 514. Intermediate Jewelry and Metalsmithing
Design and construction of jewelry and/or flatware and hollow ware as the student desires. Casting, stone setting, and production emphasized. Prerequisite:
The Arts

Arts 413 and elective by permission. 2 laboratories; 4 credits. Cost of materials for projects varies from $10 to $50.

525, 526. Wood Furniture Design
Exploration in the design and construction of major furniture forms. Development of a portfolio of completed work and investigations leading to a limited thesis. Prerequisite: Arts 425. Elective by permission. 2 laboratories; 4 credits.

567, 568. Sculpture
A studio course that investigates, through a variety of sculptural media, basic three-dimensional elements such as form, mass, texture, color, rhythm, positive-negative space, balance, variety, etc. Elective by permission. 2 laboratories; 4 credits.

601. Ceramics
Intensified development and problem solving with the ceramic media. Individual problems assigned. Prerequisite: Arts 501 and 502. Elective by permission. 1 lecture; 2 laboratories; 4 credits.

625. Wood/Environmental Design
An advanced course in the design and construction of human surroundings. Portfolio and thesis required. Prerequisite: Arts 525-526. Elective by permission. 2 laboratories; 4 credits.

667. Casting
A course designed for students whose major emphasis of study is in a three-dimensional discipline. The production of wax models, venting, investing, casting, chasing, and mounting of finished work will provide the student with an opportunity to carry on independent experimentation and study within the medium of cast bronze and aluminium sculpture. Prerequisite: Arts 567 or 525 or 501 or 502 or 568 or 513. Elective by permission. 2 laboratories; 4 credits.

668, 669. Advanced Sculpture
A course for advanced students in sculpture who have sufficient background to perform individual and independent research into technical and aesthetic solutions of contemporary problems. Individual criticism. Prerequisite: Arts 567, 568, and 667. Elective by permission. Laboratories arranged; 4 credits.

Two-Dimensional Courses

An introductory course in hand weaving using 2-12 harness looms and tapestry frame. Design and weaving of fabrics, table linens, rugs, and hangings. A 4-harness pattern workshop included. Elective by permission. 2 laboratories; 4 credits. Second semester this course is open to Occupational Therapy majors for 2 credits. Cost of materials for projects varies from $10 to $50.

431. Visual Studies
A studio course exploring fundamental composition problems related to 2-dimensional art forms using black and white and color. Elective by permission. 2 laboratories; 4 credits.

432. Drawing I
A studio drawing course that investigates, through a variety of drawing approaches, basic visual elements such as form, line, space, texture, composition, etc. Elective by permission. 2 laboratories; 4 credits.
433. Color
A basic studio course designed to heighten the student's visual perception of color by investigating its behavior and interaction in two-dimensional space. A variety of problems will deal with illusion, optical mixture, interpenetration, transparency, after image, color change, etc. and will be explored through the medium of collage. Elective by permission. 2 laboratories; 4 credits.

451. Introduction to Photography
The basic theory and practice of photography, covering equipment and materials, camera operation, developing, and printing. Creative solutions are sought to problems designed to increase the students perception. Elective by permission. 1 lecture; 1 laboratory; 4 credits.

455. Drafting and Architectural Design
Basic drafting procedures, including lettering. Study of architectural symbols and interpretation of architectural plans. Problems of architectural design with emphasis on space utilization and space planning. Elective by permission. 1 lecture; 2 laboratories; 4 credits.

519. Intermediate Weaving
Exploring weaves and fibers. Drafting to fabric analysis. Four to twelve harness pattern workshop. Elective by permission. Prerequisite: Arts 419. 1 laboratory; 4 credits. Cost for project materials varies from $20 to $50.

532. Drawing II
An extensive course in drawing in studio and from nature; still life and figure drawing in pencil, pen and ink, chalk, and charcoal, etc. Objective drawing as a means of seeing and expressive use of the media will be stressed. Prerequisite: Arts 432 and elective by permission. 2 laboratories; 4 credits.

533. Drawing III
A studio drawing course concentrating on the figure with assigned drawing projects. Prerequisite: Arts 431, Intermediate Drawing. Elective by permission. 2 laboratories; 4 credits.

534. Drawing IV
An advanced drawing course that while based on weekly compositional assignments will concern itself primarily with the individual student. The course will lead toward conceptual exercises using mixed media. Prerequisite: Arts 533. Elective by permission. 2 laboratories; 4 credits.

536. Introductory Printmaking
A basic graphics course studying a range of media and executing prints using wood, metal, and plastic. Prerequisite: Arts 532 and elective by permission. 2 laboratories; 4 credits.

537. Lithography and Serigraphy
Expression and experimentation in two graphic techniques: Lithography in black and white and further exploration in color, and Serigraphy (Silk Screen) in black and white plus color; various film, stencil, glue and tusche resists. Elective by permission. (Offered alternate years.) 4 credits.

542. Beginning Oil Painting
An introductory studio course in oil painting. Use of the media, color, and composition are studied in still life, figure, landscape, and conceptual assignments. Normally this course follows and continues the experience of Arts 532. Elective by permission. 2 laboratories; 4 credits.
The Arts

547, 548. Intermediate Painting
An intermediate level studio course designed to continue Arts 532, 542. A further exploration on the aspects of composition, color, and conceptualization as introduced in Beginning Oil Painting 542. Elective by permission. 2 laboratories; 4 credits.

544. Water Media
A studio course dealing with various water media, transparent and opaque, with emphasis on watercolor and inks. Tempera and polyvinal will also be introduced. Prerequisite: Arts 532 and elective by permission. 2 laboratories; 4 credits.

545. Water Media II
A continuation and development of the various water media experiences of Arts 544 with the introduction of Egg Tempera and mixed Media. Prerequisite: Arts 544. Elective by permission. 2 laboratories; 4 credits.

551. Intermediate Photography
Introduction to the basic theory and practice of color photography. Discussions and demonstrations of special camera and laboratory controls for creative photography. Projects may be executed in black and white or color. A portfolio of photographs and a term paper will be required at the end of the semester. Prerequisite: Arts 451 and elective by permission. 1 laboratory; 4 credits.

636. Intaglio Workshop
A graphic workshop concentrating on the techniques and problems of intaglio printmaking: drypoint, etching, aquatint, engraving, and collography, with emphasis on means toward the expression of individual imagery through these media. Prerequisite: Arts 536, Introductory Printmaking. Elective by permission. 2 laboratories; 4 credits. (Offered alternate years.)

643, 644. Advanced Painting
An advanced studio course in which the student is expected to work independently on assigned projects and with individual criticism. This course may be taken a second time with emphasis on the particular need of the individual. Prerequisite: Arts 542, and 547, 548. Elective by permission. Laboratories arranged; 4 credits.

651. Advanced Photography
A course for the serious student of photography. Application of new materials and controls to projects designed for the individual student. Color and/or black and white. Emphasis on the graphic expression of a personal point of view. A portfolio of photographs will be required at the end of the semester. Weekly seminars and group critiques. Elective by permission. Prerequisite: Arts 451, 551. 1 4-hour laboratory. It is recommended that students provide their own camera equipment.

796. Problems in the Visual Arts
Advanced students may select a special problem in one of the visual arts; i.e., (1) Photography, (2) Sculpture, (3) Drawing, (4) Painting, (5) Graphics, (6) Water Media, (7) Drafting and Architectural Design, (8) Art Education, (9) Curatorial Assistant, (10) Art History, (11) Ceramics, (12) Jewelry and Metalsmithing, (13) Weaving, or (14) Wood Design, in which they have exhibited proficiency, to be developed by means of conferences and studio work. Prerequisite: permission of department chairman. Hours to be arranged. Credits to be arranged. This course may be repeated to a total of not more than 8 credits.
798. Seminar in the Visual Arts
Seminar designed to provide a forum for synthesizing visual experiences. Students will explore intellectual assumptions underlying works of art. Readings, discussions, viewings, and written papers. Required of all students in the B.F.A. program. Other advanced students may elect with instructor's permission. 1 laboratory; 4 credits.

History of Art

475, 476. Introduction to The Arts
A broad survey of the history of Western Art. Prehistoric through Gothic, first semester; Gothic through twentieth century, second semester. 4 credits.

577. Nineteenth Century Painting and Sculpture
The history of European painting and sculpture from the French Revolution to the late nineteenth century. Prerequisite: Arts 476 or permission of instructor. 4 credits.

578. Twentieth Century Painting and Sculpture
The history of European painting and sculpture from the late 19th century to the present. Prerequisite: Arts 476 or permission of instructor. 4 credits.

582. Classical Art
A survey of the monuments in Greece and Rome covering the following periods: archaic, classical and Hellenistic in Greece, and the area influenced by Greek culture; late Republican and Imperial Rome. Significant works from about the mid-eighteenth century B.C. to the second and third centuries. A.D. are analyzed chronologically. A comprehensive picture of the classical achievement, primarily in architecture and sculpture, and modern debts to the past. Prerequisite: Arts 475 or permission of instructor. 4 credits. (Alternate years.)

583. Primitive and Oriental Art
An inquiry into the origins of art in pre-history, an investigation of the art of selected primitive cultures, and a study of Oriental art concentrating on the pictorial development of China and Japan. This course is primarily concerned with the evolution of pictorial and sculptural images essentially foreign to the classic western tradition. 4 credits. (Alternate years.)

585. American Architecture
A chronological survey of architecture in the United States from earliest Colonial times to the present. Architectural field trips in New Hampshire, Massachusetts, and Maine. 4 credits. (Alternate years.)

586. American Art
A chronological survey of painting and sculpture in the United States from the Colonial period to the present, with particular attention to works from collections in New Hampshire and Massachusetts. Prerequisite: Arts 476 or permission of instructor. 4 credits.

587. Baroque Art
A survey of the arts of the seventeenth century. The course will focus on painting, sculpture, and architecture in Italy and France; painting in Spain and Lowlands; and architecture in England. Prerequisite: Arts 476 or permission of instructor. 4 credits.

588. Modern Architecture
Study of the major trends in European and American Architecture and city planning since the mid-nineteenth century. Directions in contemporary archi-
tecture. Visits with architects to contemporary buildings in the area. 4 credits. (Alternate years.)

589. **Italian Renaissance Art I**
A survey of painting, sculpture and architecture of Trecento and Quattrocento. Emphasis on Giotto, Masaccio, Piero della Francesca, Alberti, Brunelleschi, Ghiberti, Donatello, Mantegna, and Bellini. Prerequisite: Arts 476 or permission of instructor. 4 credits.

590. **Italian Renaissance Art II**
A continuation of Arts 589. Emphasis on the major figures of the High Renaissance: Bromarte, Leonardo, Raphael, Michelangelo, and Titian. Prerequisite: Arts 476 or permission of instructor. 4 credits.

591, 592. **History and Theory of the Film**
A survey of film from its beginning in the 1890's to the present, and the literature, both critical and theoretical, that has grown up about the film. Although not exhaustive, this course covers documentary, feature, and experimental film. Historically oriented, this course will stress the relationship between film and the history of art. The first semester will survey film from the silent era to the beginnings of sound. The second semester will cover the development of the documentary film both here and in Europe, its impact upon the feature film made in Hollywood, and post-World War II developments. As in the first semester, the films of Flaherty will be focused upon, and his chronological development will be the historical framework for the course in the second semester. Although each semester can be taken by itself, the course is conceived of as a unit covering a year's work. 1 lecture; 2 recitations; 4 credits. Course fee, $10.

684. **Medieval Art**
A survey of the vast material of the Middle Ages, from the first and second centuries A.D. to the fourteenth century, covering architecture, sculpture, mosaics, manuscripts, and the minor arts. The transitional character of this vast period will be stressed, as well as its dependence upon the antique past. Architecture and the more minor arts will be accentuated. Prerequisite: Arts 475 or permission of instructor. 4 credits. (Alternate years.)

686. **Northern Painting**
The development of painting in France, Germany, and the Lowlands from the manuscript illuminators of the fourteenth century to Durer and Holbein in the sixteenth century. Prerequisite: Arts 476 or permission of instructor. 4 credits.

797. **Seminar in Art History**
Selected topics in the History of Art which will vary. Open to advanced undergraduate students. Required of Arts Majors selecting Art History option. Topics will be announced prior to registration. Prerequisite: permission of instructor. May be taken more than once with permission of adviser. 4 credits.

**Art Education**

491. **Contemporary Media**
The uses of contemporary media such as file, slides, tapes, light shows, and television in the classroom will be discussed. Students will explore the possibilities for creative expression using these media. The course will consist of field trips, lectures, and studio experiences. Prerequisite: permission of instructor. 4 credits.
493. Introduction to Art Education
A course designed to acquaint students with the philosophies, methodologies, and practices of art education in public schools. The course will consist of in-school experiences, lectures, seminars, and studio practices. Special emphasis is placed on developing techniques for fostering creative art experiences in the schools. Elective by permission. 4 credits.

791. Problems of Teaching Art in Secondary Schools
The purpose and objectives of teaching art in the secondary schools; selection and organization of teaching materials; teaching techniques which may be advantageously employed in the secondary-school art program. Prerequisite: Education 657 and Art-Education 792 with a grade of C or better. Elective by permission. 2 lectures; 1 laboratory; 4 credits.

792. Problems of Teaching Art in Elementary Schools
The purposes and objectives of teaching art in elementary schools; selection and organization of teaching materials; teaching techniques which may be advantageously employed in the elementary schools. Prerequisite: Education 657 and elective by permission. 1 lecture; 1 recitation; 2 laboratories; 4 credits.

Biochemistry (18)
Chairman: Edward J. Herbst


ASSOCIATE PROFESSOR: Gerald L. Klippenstein

ASSISTANT PROFESSOR: James A. Stewart

402. Biochemistry and Man
This course, designed to be of interest to all students, will examine the biochemical principles man uses to modify his existence. The biochemical basis of disease treatment and prevention, nutrition, industrial processing, food manufacture, and the role played by biochemical reactions in pollution and its control are among the topics covered. Prerequisite: secondary school level general chemistry. Mr. Green. 3 lectures; 4 credits.

501. Biological Chemistry
An introduction to biological chemistry. Mr. Teeri. Prerequisite: One semester of chemistry. 3 lectures; 1 laboratory; 4 credits.

601. General Biochemistry
An introduction to the general principles of biochemistry. Mr. Ikawa. Prerequisite: elementary organic chemistry. 3 lectures; 1 laboratory; 4 credits.

656. Physiological Chemistry and Nutrition
An introductory biochemistry course with emphasis on human physiological chemistry and nutrition. The laboratory includes a study of procedures basic to chemical methods used in medical diagnostic work. Mr. Teeri. Prerequisite: satisfactory preparation in organic chemistry. 3 lectures; 1 laboratory; 4 credits.

699 (699). Senior Thesis
Participation in research in biochemistry. For seniors majoring in biochemistry who have completed Biochemistry 751. Staff. 2 credits.
Biology

751. Principles of Biochemistry
The fundamental principles of biochemistry with emphasis on the chemistry, metabolism, and biological function of nucleic acids, proteins, carbohydrates, and lipids. Mr. Klippenstein and Mr. Stewart. Prerequisite: one year of organic chemistry or permission of instructor. 3 lectures; 1 laboratory; 4 credits.

752. Topics in Biochemistry
A detailed consideration of metabolism and of current developments in biochemistry. Mr. Herbst and guest lecturers. Prerequisite: Biochemistry 751. 2 lectures; 2 credits.

762. Plant Metabolism
The function, occurrence, synthesis, and degradation of plant constituents. Emphasis is placed on respiration and photosynthesis and the metabolism of nitrogenous and aromatic compounds. Biochemical mechanisms such as those involved in seed dormancy, fruit ripening, and disease resistance are discussed in relation to their roles in plant survival. Mr. Routley. Prerequisite: Biochemistry 751 or equivalent. 2 or 4 credits.

770. Biochemical Genetics
The biochemical mechanisms of storage, replication, transmission, transcription, recombination, mutation, and expression of genetic information by cells and viruses. Mr. Green. Prerequisite: Biochemistry 751 or permission of instructor. 3 lectures; 1 laboratory; 4 credits. (Alternate years; offered in 1973-74.)

795, 796. Investigations in Biochemistry
Staff. Prerequisite: permission of instructor. Subject matter and hours to be arranged. 2 credits.

Biology (60)
Courses coordinated by the Chairman of the Biological Sciences Division, College of Liberal Arts

The following courses (excepting Biology 541, 543, and 791) are intended primarily for the non-major and to satisfy the distribution requirement for science.

401. Human Biology
An elementary consideration of the structure, function and development of the systems of the human body. 4 credits. No credit toward a major or minor. Students who have received credit for Zoology 507-508 cannot receive credit for Biology 401.

(402), 402. Man and His Environment
Elementary considerations of biological principles from selected areas in population and ecosystem ecology, exploring their impact on the living and nonliving worlds; man’s modification of his environment and its consequences. 4 credits. No credit toward a major or a minor. Students who have received credit for Biology 541 or 641 cannot receive credit for Biology 402.

(403). The Living World
A basic course in general biology: survey of plant and animal kingdoms and elementary principles of heredity, evolution, and ecology. 4 credits. No credit toward a major or minor.
(404). Heredity and Man
The genetic basis for variation, with emphasis given to human inheritance. Topics include normal and abnormal chromosome complements, the mutable gene and its relation to expression, including genetic diseases, and the genetic material in evolution. 4 credits. No credit toward a major or minor. Students who have received credit for Zoology 604 cannot receive credit for Biology 404.

(407). Concepts in Cell Biology
An experimental and historical approach to selected topics in cell biology. Emphasis will be placed on those cell structures which play an important role in the development of the adult organism from the egg. Within this context, the philosophy and practical limitations of research in biology will be considered. 4 credits. No credit toward a major or minor.

409, (409). Human Reproductive Biology
Consideration of all aspects of human sexuality from anatomical, physiological, and a variety of other viewpoints. Emphasis on those aspects of greatest concern to college-age students. 4 credits. No credit toward a major or minor.

541, (541). General Ecology
Interrelationships between organisms and their physical environment, population growth, structure, and species interactions; introduction to the ecosystem: energetics, succession and structure, with examples drawn from marine, freshwater, and terrestrial habitats. Prerequisites: introductory chemistry, Botany 411, Zoology 412, or equivalent. 4 credits.

543, (543). Field Ecology
Consideration of ecological principles through exercises in selected natural habitats and in the laboratory. The ability to analyze, quantify and synthesize ecological information will be stressed. Prerequisites: Math 427 or statistics or equivalent, present or prior enrollment in Biology 541 and permission of instructor. 1 laboratory; 2 credits.

791. Problems in the Teaching of High School Biology
Objectives and methods of teaching. The selection and organization of materials, preparation of visual aids, setting up of aquaria and other projects. The use of the field trip as a tool in teaching high school biology. Prerequisite: two years of biological science and permission of instructor. 4 credits.
Botany and Plant Pathology (19)
Acting Chairman: M. K. Biggs

PROFESSORS: Stuart Dunn, emeritus; Charlotte G. Nast, emerita; Albion Hodgdon, Avery Rich, Richard Schreiber

ADJUNCT PROFESSOR: Alex L. Shigo

ASSOCIATE PROFESSORS: Arthur C. Mathieson, Hugh F. Mulligan

ASSISTANT PROFESSORS: Marion E. Mills, emerita; May Biggs, A. Linn Bogle, Brian F. Chabot, Robert Blanchard, William MacHardy

ADJUNCT ASSISTANT PROFESSOR: Terry Tattar

INSTRUCTOR: Alan Baker

411, (411). General Botany
An introduction to plant science. The evolution of structure and function in the plant kingdom. Mr. Schreiber, Ms. Biggs. 3 lectures; 1 laboratory; 4 credits.

503. The Plant World
Presenting a survey of the plant kingdom from an evolutionary point of view, beginning at the level of single-celled plants and tracing the development of structure and function of plant organs in, and inter-relationships of, the major groups of plants. Mr. Bogle. Prerequisite: Botany 411 (or equivalent with permission of instructor). 2 lectures; 2 laboratories; 4 credits.

525. Introduction to Marine Botany
The life history, classification, and ecology of marine macroscopic and microscopic plants, including phytoplankton, sea weed, and salt-marsh plants. The course is divided into three equal portions; microscopic marine plants, macroscopic marine plants, and the interactions between man and marine plant communities. Several optional Saturday morning field trips will be offered. Prerequisite: either Botany 411, a semester of Biology, or permission of instructor. Mr. Mulligan. 3 lectures; 1 laboratory; 4 credits.

566. Systematic Botany
The scientific basis of plant taxonomy and the identification and classification of our native trees, shrubs, and wild flowers. Mr. Hodgdon. Prerequisite: one semester of biological science. 2 laboratories; 4 credits.

606. Plant Physiology
An introduction to the function of higher plants with an emphasis on water relations, metabolism, growth and development. Ms. Biggs and Mr. Pollard. Prerequisite: Botany 411, 503, or Plant Science 421 and one year of chemistry or permission of the instructor. 3 lectures; 1 laboratory; 4 credits.

721. Freshwater Phycology
Identification, classification, ecology, and life histories of the major groups of freshwater algae. Periodic field trips will be scheduled throughout the semester. Mr. Baker. Prerequisite: Botany 411 or 503. 2 lectures; 2 laboratories; 4 credits. (Alternate years; offered in 1973-74.)

722. Marine Phycology
Identification, classification, ecology, and life histories of the major groups of marine algae. Particular emphasis will be placed upon the benthonic, marine algae of New England. Laboratories will include field trips during the latter portion of the course. Mr. Mathieson. Prerequisite: Botany 411 or 503. 2 lectures; 2 laboratories; 4 credits. (Alternate years; offered in 1973-74.)
723. Marine Algal Ecology
The distribution, abundance, and growth of marine plants in relation to their environment (chemical, physical, and biological). The students will be expected to attend regular, planned field trips and to conduct an independent research project. Mr. Mathieson. Prerequisite: Botany 722, Zoology 715, or permission of instructor. 2 lectures; 1 laboratory; field trips; 4 credits. (Alternate years; not offered in 1973-74.)

724. Freshwater Algal Ecology
Fresh-water algal habitats, the principles prerequisite to understanding man's impact on algal communities of lakes and streams. Winter and spring field problems will be carried out. Mr. Baker. Prerequisite: Botany 721 or permission of instructor. 2 lectures; 2 laboratories; 4 credits.

727. Introduction to Marine Phytoplankton
A study of the taxonomy and life histories of marine phytoplankton from fresh and preserved marine plankton collections. Cultural techniques and current methods for assessing standing crop and productivity will be studied. Mr. Mulligan. 2 lectures; 2 laboratories; 4 credits.

728. Marine Phytoplankton Ecology
Study of spatial and temporal distribution of phytoplankton populations in oceans and estuaries with emphasis on interactions with the physical, chemical, and biological aspects of their environment. Laboratories will cover methods of collecting and evaluating phytoplankton populations. Mr. Mulligan. 2 lectures; 2 laboratories; 4 credits.

732. Cell Biology
The structure, physiological behavior, and development of cells. The cellular basis of heredity. Mr. Schreiber. Prerequisite: one year each of the biological sciences and of chemistry. 3 lectures; 1 seminar; 4 credits.

735. Cell Physiology (Plant)
The integration of the molecular nature of structure with the functions of living cells. The emphasis is on algae cells. Mrs. Biggs. Prerequisite: one year of general chemistry and one year of biological sciences; or permission of instructor. 2 lectures; 2 laboratories; 4 credits.

741. Ecosystem Analysis
Description of ecosystems with respect to: structure of population and community components, development, transfer of energy and materials, and evolutionary changes. Methods of analysis and interpretation of field data. Mr. Chabot. Prerequisite: Biology 641 or permission of instructor. 1 lecture; 1 laboratory; 1 colloquium; 4 credits.

742. Physiological Ecology
The physiological basis of plant-environment interactions will be considered for cellular, whole plant, and population processes. Biometeorology, physiological adaptation and variation, evolution of ecotypes, growth and reproductive phenomena, and mathematical simulation of plant processes will be included. Mr. Chabot. Prerequisite: Botany 706 or permission of instructor. 1 lecture; 1 laboratory; 1 colloquium; 4 credits.

747. Aquatic Higher Plants
A survey of flowering plants, fern relatives, and Bryophytes found in and about bodies of water in northeastern United States. Extensive field work, preparation techniques, representative collections, herbarium work, lectures, and discussions.
Botany and Plant Pathology

Mr. Hodgdon. Prerequisite: Botany 566. 1 lecture; 1 colloquium; 1 half-day laboratory; 4 credits. (Alternate years; not offered in 1973-74.)

751. Plant Pathology
The nature of disease in plants; the symptomatology, etiology, and classification of plant diseases. Mr. Rich. Prerequisite: Botany 411 or 503 or equivalent. 2 lectures; 2 laboratories; 4 credits.

752. Mycology
Studies of the parasitic and saprophytic fungi, their growth, reproduction, and identification. Living specimens from all groups will be examined. Techniques in preparing pure cultures will be stressed. Mr. Blanchard. 2 lectures; 2 laboratories; 4 credits.

753. Forest Pathology
Forest and shade tree diseases: principles, etiology, epidemiology, and control. Mr. Blanchard. Prerequisite: Botany 411 or Botany 503, or equivalent. 2 lectures; 2 laboratories; 4 credits.

(754). Principles of Plant Disease Control
Exclusion, eradication, protection, immunization, and the specific practical methods used to control plant diseases. Mr. MacHardy. Prerequisite: Botany 751 or 753. 1 lecture; 2 laboratories; 4 credits. (Alternate years; offered in 1973-74.)

758. Plant Anatomy
The anatomy of vascular plants with special emphasis upon tissue development and structure. Mr. Bogle. Prerequisite: Botany 411 or 503. 2 lectures; 2 laboratories; 4 credits. (Alternate years; not offered in 1973-74.)

762. Morphology of the Vascular Plants
The life histories and evolution of the extinct and living vascular plants, including comparisons of general structure and sexual organs. Mr. Bogle. Prerequisite: Botany 411 or 503. 2 lectures; 2 laboratories; 4 credits. (Alternate years; offered in 1973-74.)

764. Microtechnique
A methods course in embedding, sectioning, and staining plant tissues, and an introduction to microscopy. Mr. Bogle. Prerequisite: permission of instructor. 2 lectures; 4 hours of laboratory; 4 credits. (Alternate years; not offered in 1973-74.)

767. Advanced Systematic Botany
The principles and rules of plant classification and nomenclature, study of plant families, field and herbarium work. Mr. Hodgdon. Prerequisite: Botany 566. 1 lecture; 1 colloquium; 1 laboratory (full afternoon); 4 credits. (Alternate years; offered in 1973-74.)

Individual projects under faculty guidance. Elective only by permission of the appropriate instructor. Hours to be arranged, 2 or 4 credits.

799. Botany Seminar
Presentation and discussion of oral reports on research with practice in use of visual aids. Participation by all resident departmental majors. Botany Club in charge. 1 hourly session per week, 0 credit.
Chemical Engineering (46)
Chairman: Stephen S. T. Fan

PROFESSORS: Irvin Lavine, emeritus; Oswald T. Zimmerman, emeritus
VISITING PROFESSOR: Yin-Chao Yen
ASSOCIATE PROFESSOR: Stephen S. T. Fan
ASSISTANT PROFESSORS: Steven M. Slater, Robert S. Torrest, Gail D. Ulrich
INSTRUCTOR: Stephen D. Foss

410. Current Topics in Chemical Technology
Introduction to current topics in chemical technology including energy use and conversion; the causes and control of atmospheric and water pollution; solid waste problems; plastics and synthetic materials; corrosion and protective coatings and discussion on controversial current problems in chemistry and engineering. Prerequisite: strong chemistry background in high school. 3 lectures; 1 recitation; 4 credits.

501. Introduction to Chemical Engineering I
An overview of the profession; the presentation and interpretation of engineering data; introduction to systems of units; dimensional analysis and heat and material balance; computer programming. 2 credits.

502. Introduction to Chemical Engineering II
A study of chemical equilibrium and heats of reaction needed to describe systems undergoing chemical change; an intensive treatment of heat and material balances on complex systems. 4 credits.

601. Fluid Mechanics and Unit Operations
Development of the continuity, momentum, and energy equations; laminar and turbulent flow in pipes and boundary layers; rheology. Applications to unit operations including flow in porous media, filtration, and fluidization. 3 lectures; 1 laboratory; 4 credits.

602. Heat Transfer and Unit Operations
Thermal properties of materials, steady-state and transient conduction and convection; applications to heat exchangers and process equipment. 3 lectures; 1 laboratory; 4 credits.

603. Applied Mathematics for Chemical Engineers

604. Chemical Engineering Thermodynamics
The thermal properties of matter; the first law; the second law; useful thermodynamic functions; behavior of ideal and real gases and liquids; volumetric and phase behavior; cycles; steady-flow processes; compression of gases; refrigeration and liquefaction of gases. 3 lectures; 1 recitation; 4 credits.

605. Mass Transfer and Stagewise Operations
Diffusion in gases, liquids, and solids; mass transfer phenomena including stagewise operations; design and analysis of process equipment. 3 lectures; 1 laboratory; 4 credits.
606. Chemical Engineering Kinetics
Study of chemical kinetics and the use of laboratory data to design commercial reactors. Analysis of continuous, batch, plug-flow, and well-stirred reactors for homogeneous and catalytic multiphase reactions. 3 lectures; 1 laboratory; 4 credits.

607. Physical Metallurgy
An introductory study of the nature of metals, emphasizing the quantum mechanical description of the solid state and including atomic structure, bonding, historical development of metal theories, elementary zone or band theory, and X-ray diffraction. The microscopic metal system, thermodynamics of metallurgical processes, defects and dislocations, phase relations of pure metals and alloys, microstructure, and physical and thermal treatment of metals. Study of some non-metals. 3 lectures; 1 laboratory; 4 credits.

608. Chemical Engineering Design
The principles of cost engineering, including estimation of plant investment, working capital, operating costs, labor requirements, payout time and profitability, value of money, capitalized costs, simple and compound interest, depreciation, taxes and insurance, overhead, financing of chemical enterprises, design of equipment and plants for minimum cost, plant location, transportation, sales cost, equipment cost, and cost indexes. Each class selects one or more problems involving the complete design of a chemical plant. For each problem, the most desirable process must be determined; the site-selected; the equipment and plant designed; calculations made for all costs, profitability, and payout time; and a complete report prepared, including the drawings of equipment and plant layout. 1 lecture; 3 laboratories; 4 credits.

609. Fundamentals of Air Pollution and Its Control
The nature of air pollution sources, pollutant transfer, and effects. Discussion of regulatory, administrative, legal, and social aspects of air pollution, as well as engineering aspects of control. 4 credits.

695. Chemical Engineering Project
Each student selects a research problem which he carries out independently under faculty supervision. Intensive study in both the library and the laboratory and a satisfactory report upon completion of the work are required. 24 credits.

696. Independent Study
Individual study projects in various areas of chemical engineering as determined to be of particular interest and value to the student. Permission of the student's adviser and department chairman are required. Permission will be granted only to those students who have proved their ability by superior scholastic achievement. 14 credits.

701. High Polymers
Principles and practice of high polymer manufacture, including industrial polymerization methods and equipment design. Laboratory work includes typical polymerization reactions and the physical and chemical testing of various types of plastics and synthetic fibers. 3 lectures; 1 laboratory; 4 credits.

712. Introduction to Nuclear Engineering
The scientific and engineering development of nuclear reactors, including basic binding-energy physics, nuclear stability, radioactivity, the elements of nuclear reactor theory, and the engineering problems of heat transfer, fluid flow, materials selection, and shielding. 4 credits.
713. Nuclear Chemical Technology
The design, construction, and operation of nuclear process equipment, including reactors and associated chemical processing facilities, and isotope separation plants. The technology of applied radiation chemistry. 3 credits.

750. Introduction to Process Simulation and Operations

752. Process Dynamics
A basic treatment of process dynamics, including a study of first- and second-order linear processes and their response to step and sinusoidal driving functions. Graphical analysis of the entire control system is included with special emphasis on the optimum design of a stable system. 4 credits.

762. Introduction to Optimization

772. Physicochemical Processes for Water and Air Quality Control
The origins and characterization of pollutants. Basic processes in water and air pollution control including filtration, sedimentation, coagulation and flocculation, adsorption and absorption. Elements of process fundamentals including applied fluid mechanics, mass transfer, and kinetics will be presented. Other topics will be thermal pollution, chemical treatment, oil spills on water and aeration. 3 lectures; 1 laboratory; 4 credits.

Chemistry (47)
Chairman: Alexander R. Amell


Assistant Professors: N. Dennis Chasteen, Colin D. Hubbard

*401-402. General Chemistry
Elementary chemistry including laboratory work. The emphasis is on a largely nonmathematical, broad view of chemistry including topics of general interest appropriate for students who intend to take no additional chemistry course. Included are students whose major department requires this course, and those

* Students may receive credit for only one of the following courses from 401, 403, 405 and 407, and for only one course from 402, 404, and 408.
interested in satisfying a science requirement. Cannot be used as a prerequisite for other chemistry courses without permission of the chemistry department. 3 lectures; 1 laboratory; 4 credits.

*403-404. General Chemistry
The fundamental laws and conceptions of chemistry, including a study of the non-metals and metals and their compounds. The theoretical principles are illustrated by lecture demonstrations and the applications of chemistry in the professions are explained. For students who plan to take further courses in the Department of Chemistry. 3 lectures; 1 laboratory; 4 credits.

*405. Introductory Chemistry
A discussion of the basic principles of chemistry, including atomic structure, bonding, equilibria, and thermodynamics, as the first course for chemistry majors. Presupposes secondary-school chemistry. Cannot be taken for credit if credit received for Chem. 403-404. 3 lectures; 1 laboratory; 4 credits.

406. Quantitative Analysis
A systematic treatment of the theory and techniques of volumetric and gravimetric analysis. The course is designed for those with a professional interest in chemistry. Normally this course will be followed by an advanced course in instrumental methods of chemical analysis. Prerequisite: Chemistry 405 or 404. 3 lectures; 1 laboratory; 4 credits.

*407 408. Background of Chemical Ideas
The development of present-day chemical theories in their historical and philosophical context, and their relationships to other fields of human thought. The emphasis is on class discussion and concentrated study of topics of interest to the individual student. Cannot be used as prerequisite for other Chemistry courses. 3 lectures; 4 credits.

517. Quantitative Analysis
An introductory course in quantitative analysis, including gravimetric, volumetric, and instrumental methods, for those students desiring a brief terminal course in analytical chemistry. Prerequisite: Chemistry 404. 3 lectures; 1 laboratory; 4 credits.

545. Organic Chemistry
An introductory but comprehensive study of the chemistry of carbon compounds with emphasis on the particular phases of the subject needed by students preparing to be technicians, nurses, major in biological sciences, and others, where a brief course is desired. Prerequisite: Chemistry 404 or 405. Elective for medical technology, nursing, and majors in botany. 3 lectures; 1 laboratory; 4 credits. Students receiving credit for Chemistry 545 may not receive credit for Chemistry 547-548 or for Chemistry 651-652.

547-548. Organic Chemistry
The principal classes of organic compounds, aliphatic and aromatic, with emphasis on class reactions and structural theory. Laboratory exercises in the preparation and purification of selected organic compounds. The use of group reactions for the identification of organic substances in a systematic scheme of qualitative organic analysis. Oriented towards the physical sciences. Intended primarily for chemistry and engineering majors. Prerequisite: Chemistry 404 or 405 or permission of instructor. 3 lectures; 1 laboratory; 4 credits. Students receiving credit for Chemistry 547-548 may not receive credit for either Chemistry 545 or Chemistry 651-652.
651-652. Organic Chemistry
The principal classes of organic compounds, aliphatic and aromatic, with emphasis on class reactions and structural theory. Laboratory exercises in the preparation and purification of selected organic compounds. Oriented toward biological and health sciences. Intended primarily for pre-healing-arts students. Prerequisite: Chemistry 404 or 405 or permission of instructor. 3 lectures; 1 laboratory; 4 credits. Students receiving credit for Chemistry 651-652 may not receive credit for either Chemistry 545 or Chemistry 547-548.

653-654. Organic Chemistry Laboratory
Laboratory exercises in the preparation and purification of selected organic compounds. Students must take Chemistry 651-652 concurrently. Prerequisite: Chemistry 404 or 405. 1 laboratory; 2 credits.

663. Introductory Radiochemical Techniques
Radiochemical techniques and laboratory practice in the use of apparatus in many fields of science which utilize radiochemical operations. Prerequisite: general inorganic chemistry and general physics. 3 lectures; 1 laboratory; 4 credits.

683-684. Physical Chemistry I, II
The properties of gases, liquids, and solids; thermochemistry and thermodynamics; solutions, chemical equilibria, reaction rates, conductance, and electro motive force. Prerequisite: Mathematics 428 and physics. Undergraduates must register for Chemistry 685-686 concurrently. 3 lectures; 2 credits.

685-686. Physical Chemistry Laboratory
Experimental work illustrating the principles of chemistry. Emphasis is upon the measurement of thermodynamic properties, chemical kinetics and methods of determining the structure of matter. Prerequisite: Mathematics 428 and physics. 1 laboratory; 2 credits.

696. Independent Study
With the consent of the adviser and the departmental chairman, an exceptional student may enroll in a course of independent study. This may consist of individual reading, writing, or laboratory work, which will be carried out under the tutelage of a faculty member. The course may be used to replace specific required courses in chemistry, with approval of the adviser and department chairman. Credits to be arranged.

697. Chemical Literature
The use of the chemistry library as a research tool. Prerequisite: Chemistry 548 or 652. 1 credit.

698. Seminar
Student reports on topics of interest. Prerequisite: Chemistry 548 or 652 and 684. 1 credit.

699. Thesis
The related background and experimental observation of the year's investigation in some selected subject is required. Members of the staff. For seniors in chemistry who have completed Chemistry 548, 762, 684, and having a grade point average of 2.5, or permission of adviser and department chairman. 5 laboratories; 4 credits. NLG.

708. Research Techniques
Lectures and laboratory to show experimental methods and interpretation of results. Topics include gas liquid chromatography, data handling, nuclear mag-
Advanced Organic Chemistry
An advanced survey of methods of synthesis and determination of structure, including stereochemistry, of complex organic compounds. Structural emphasis being placed on the solution of assigned problems. The laboratory will be devoted to the synthesis and structural determination of complex organic compounds, techniques for the separation and determination of purity of unknown compounds, and the identification of these unknowns by spectroscopy and chemical means. Prerequisite Chemistry 547 or 651 or equivalent. 4 credits, or for variable credits for graduate students with permission of instructor.

Instrumental Analysis
A treatment of the theory, instrumentation, and application of methods such as atomic absorption, conductimetry, coulometry, emission spectrography, gas chromatography, polarography, potentiometry, and spectrophotometry to chemical analysis. Prerequisite: Chemistry 406; Chemistry 684 as a prerequisite or concurrently or permission of the instructor. 3 lectures; 1 laboratory; 4 credits or variable credit for graduate students with permission of the instructor. Cannot be used for graduate credit by chemistry students.

Inorganic Chemistry
The basic theoretical concepts of modern inorganic chemistry at a moderate level, and their applications to inorganic reactions and compounds. Prerequisite: Chemistry 683; Chemistry 684 pre- or corequisite; or permission of instructor. (May not be used for graduate credit by chemistry graduate students.) 4 credits, or 3 credits for graduate students by permission of instructor.

Physical Chemistry III
Introduction to quantum theory; spectroscopy; chemical bonding; statistical thermodynamics. Prerequisite: Chemistry 683. 4 credits.

Civil Engineering (48)
Chairman: Louis H. Klotz

PROFESSORS: Russell R. Skelton, emeritus; Victor D. Azzi, Charles O. Dawson, J. Harold Zoller
ASSOCIATE PROFESSORS: Louis H. Klotz, Harold E. Langley, Jr., John P. Nielsen, Robert P. Vreeland, Tung-Ming Wang
ASSISTANT PROFESSORS: Paul L. Bishop, C. Gorman Gilbert
ADJUNCT ASSOCIATE PROFESSOR: Gerald H. Batchelder

400. Civil Engineering Lectures
An introduction to the profession of civil engineering; the civil engineer as a planner, builder, and problem solver; and the goals of the civil engineering curriculum. Lectures by faculty and visitors. Required of Civil Engineering freshmen; open to others by permission of instructor. 1 lecture; 0 credit. NLG.

404. Engineering Computer Applications
Application of computer programming to the solution of basic engineering problems, using FORTRAN IV, WATFOR, and WATFIV. An introduction to the use
of Problem-Oriented-Languages such as coco. Prerequisite: Mathematics 403 or equivalent. Two lectures; one recitation. 2 credits.

501. Surveying
A course for non-civil engineering students in the theory and use of tape, level, transit, and aerial photographs in making plane and topographic surveys. Use of surveys as a basis for deeds, maps, construction, design, environmental studies, and reports involving the use of land or other natural resources. No prerequisite. 2 lectures; 2 laboratories; 4 credits.

505. Surveying
Principles of land measurements by ground and photogrammetric methods. Application of error theory to planning and adjusting engineering surveys. Conformal mapping and its application to state plane coordinate systems. Prerequisite: Civil Engineering 404, Mathematics 427-428. 2 lectures; 2 laboratories; 4 credits.

508. Engineering Graphics
Concepts and practice in orthographic projection and fundamentals of descriptive geometry. 2 laboratories; 2 credits.

523-524. Mechanics I and II
The static and dynamic behavior of rigid and deformable bodies. Equilibrium, compatibility, and force-deformation relations; stress, strain, and constitutive relations; elastic stability; energy methods; stress and deformation in materials and simple structural elements. Review of particle dynamics; kinematics and kinetics of rigid bodies in two and three dimensions. Prerequisite: Mathematics 427, Physics 407. 4 credits.

611. Environmental Planning Concepts
Course designed for students not in civil engineering. A nontechnical view of pressing urban and regional environmental problems, with an emphasis upon the common characteristics and interrelationships of these problems. Using a systems approach, the course focuses upon water quality and pollution, air pollution, thermal pollution, and transportation. Particular emphasis is upon new developments and approaches to these problems which will not be covered in engineering or mathematical detail. No prerequisites. Not open to civil engineering majors. 4 credits.

621. Transportation Planning and Design
Determination of public needs for transportation. Planning of transportation systems, and the comparison and evaluation of alternative system modifications. Analysis of non-user impacts of transportation facilities. Geometric design and traffic capacity of highways. Prerequisite: civil engineering major or approval of instructor. 3 lectures; 1 laboratory; 4 credits.

622. Engineering Materials
The structural properties and applications of the various materials used in civil engineering work, including steel, cement, mineral aggregates, concrete, timber, and bituminous materials. An introduction to the micro-structure and properties of common metals, plastics, and ceramics. Prerequisite: Junior Standing. 3 lectures; 1 laboratory; 4 credits.

642. Fluid Mechanics
Properties of fluids, fluid statics, flow of incompressible and compressible ideal fluids, flow of real fluids, measurement of fluid properties, and the characteristics of flow through various measuring devices. 3 lectures; 1 laboratory; 4 credits.

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Civil Engineering

643. Sanitary Engineering I
The sources, quantity, quality, and sanitary aspects of public water supplies, and distribution systems; and the theory and problem of sewerage. Prerequisite: Civil Engineering 642, Chemistry 403 or 405. 3 lectures; 1 laboratory; 4 credits.

665. Soil Mechanics
Soil classification and physical properties. Permeability, compressibility, bearing capacity, settlement, and shear resistance are related to the principles underlying the behavior of soils subjected to various loading conditions. Prerequisite: Civil Engineering 622, 642. 3 lectures; 1 laboratory; 4 credits.

681. Structural Analysis
The analytical stress and deflection analysis of determinate structures under static and moving load. Computer solution of beams and trusses by classical and matrix methods. Prerequisite: Civil Engineering 523-524. 3 lectures; 1 design period; 4 credits.

682. Structural Design Concepts
The basic elements of structural synthesis and design including modeling concepts for analysis-design cycles by manual and computer approaches, development of design criteria, and general structural system behavior. Prerequisite: Civil Engineering 681. 3 lectures; 1 design period; 4 credits.

685. Indeterminate Structures
The analysis of indeterminate structures, including non-prismatic members subject to static and moving loads. Solutions by classical, numerical, and computer applied methods. Prerequisite: Civil Engineering 681. 3 lectures; 1 design period; 4 credits.

695. Civil Engineering Projects
A course designed to encourage independent research, under faculty guidance, of a subject of particular interest to an individual or a small group. Prerequisite: approval of faculty member involved. 2-4 credits.

701. Advanced Surveying
Principles of instrumental and analytical photogrammetry. Theory of conformal mapping and its application to the plane coordinate systems. Geodetic surveying. Error theory and its application to the planning and adjustment of surveys. Application of electronic computers to surveying calculations. Prerequisite: Civil Engineering 505. 3 lectures; 1 laboratory; 4 credits.

711. Community Planning
An introduction to community planning. Social, economic, and physical factors affecting community planning; content and extent of desirable community planning programs—including purpose and scope; preliminary survey; elements of land planning; the master plan; transportation and circulation systems; street patterns and traffic, motor vehicle parking; airport sites; public building sites; parks and recreational facilities; zoning; control of land subdivision; neighborhood and shopping centers; housing, legal, financial, environmental and economic problems; and redevelopment of blighted areas. Prerequisite: permission of instructor. 4 lectures; 4 credits.

714. Contracts, Specifications, and Professional Relations
The essential elements and legal requirements of engineering contracts; the purposes and content of specifications; professional conduct, relations, registration, and ethics. Construction planning and management; cost analysis based on quantity surveys and unit-cost methods. Prerequisite: permission of instructor. 4 lectures; 4 credits.
721. Pavement Design
Design of flexible and rigid pavements and bases for highways, airports, and city streets; pavement selection, construction methods, materials, specifications, and engineering cost estimates. Prerequisite: Civil Engineering 620 and 665. 3 lectures; 1 laboratory; 4 credits.

731. Network Planning and Scheduling
The application of critical path methods (CPM) and project evaluation review technique (PERT) to the design and control of engineering projects. 1 lecture; 1 laboratory; 2 credits.

732. Systems Analysis
An analysis of engineering projects encompassing social and economic criteria as well as engineering feasibility studies. 2 lectures; 2 credits.

744. Sanitary Engineering
The essential elements of water supply and wastewater disposal unit operations and processes. Prerequisite: Civil Engineering 643. 3 lectures; 1 laboratory; 4 credits.

745. Hydrology and Hydraulics
The occurrence and physical effects of water on the earth, including meteorology, ground-water runoff and stream-flow routing, open-channel flow, reservoirs, control works, hydroelectric power, irrigation, drainage, and multipurpose projects. Prerequisite: Civil Engineering 642. 4 lectures; 4 credits.

746. Wastewater Treatment Plant Design
A study of the fundamental factors affecting choice of treatment units. Design of the components of a wastewater treatment plant and the preparation of a plan for a particular city that comprises a suitable combination of the units previously designed. Prerequisite: Civil Engineering 744. 3 lectures; 1 design period; 4 credits.

747. Water Treatment Plant Design
Concepts, principles and theory of water treatment plant design using a water source for a particular city and developing a treatment system for that community. Prerequisite: Civil Engineering 744. 3 lectures; 1 design period; 4 credits.

748. Solid Waste Disposal
Study of basic concepts and theory of solid waste collection and disposal systems. Design methods involved in disposal system. Prerequisite: Civil Engineering 643. 3 lectures; 1 design period; 4 credits.

751. Transportation Planning
The techniques used to predict the demand for transportation services. The transportation planning process including trip generation, distribution, mode choice, network assignment, and system evaluation. The use of computer models to study transportation facilities in New England. Prerequisite: Civil Engineering 621 or permission of instructor. 3 lectures; 1 laboratory; 4 credits.

753. Urban and Regional Systems Analysis Methods
The mathematical techniques necessary in the analysis of urban and regional systems. Matrix operations, regression analysis, linear programming, network analysis, factor analysis, and stochastic systems. Emphasis on computer applications to regional systems in New England. Prerequisite: Mathematics 427 or permission of instructor. 3 lectures; 1 laboratory; 4 credits.
Civil Engineering

754. Analysis of Urban and Regional Systems
The application of analytical techniques to regional systems in New England. Individual or group projects concerned with such systems as migration, transportation, health care, education, recreation, and sanitation. Prerequisite: Civil Engineering 753 or permission of instructor. 3 lectures; 1 laboratory; 4 credits.

765. Foundation Engineering
Application of the principles of soil mechanics to selection of the type of substructure; determination of allowable soil-bearing capacities based on rupture and settlement theories; determination of active and passive earth pressures; and foundation construction methods. Computations by classical, numerical, and computer applied methods. Prerequisite: Civil Engineering 665, 682, and senior standing. 3 lectures; 1 design period; 4 credits.

768. Seepage through Earth Structures
Fundamentals of groundwater flow, Darcy's Law, flow nets, Deputies theory and application, conformal mapping techniques, confined flow, flow through earth and rock structures, seepage towards wells. Prerequisite: Civil Engineering 665 and Civil Engineering 642. 2 lectures; 2 credits.

782. Timber Design
Properties and characteristics of structural woods, mechanics of wood, connection methods, design of timber members, and connections in beams, columns, and trusses, and glued laminates of wood. Prerequisite: Civil Engineering 682 and permission of instructor. 1 lecture; 1 design period; 2 credits.

784. Structural Analysis by Matrix and Numerical Methods
Presentation of a unifying concept of basic structural analysis theories, introduction to matrix and numerical methods of analysis, and their application by linear graph concepts using computers. Prerequisite: Civil Engineering 685. 3 lectures; 1 design period; 4 credits.

790. Inelastic Structural Design
A continuation of modern design theory, ultimate design of reinforced concrete, and plastic analysis of steel structures. 4 lectures; 4 credits.

793, 794. Advanced Structural Design I and II
The design in steel by elastic and plastic theories and in reinforced concrete by the working stress and ultimate strength methods for structural elements and connections using the appropriate controlling specifications. Prerequisite: Civil Engineering 682 or permission of instructor. 3 lectures; 1 design period; 4 credits.

795-796. Independent Study
A limited number of qualified senior and graduate students will be permitted to pursue independent studies under faculty guidance. Seniors may write terminal theses reporting the results of their investigations. 2-4 credits.
Earth Sciences

Classics
(See Spanish and Classics)

Community Development
(See Institute of Natural and Environmental Resources)

Computer Science
(See Interdisciplinary Programs and Options and Math Program Description, pages 128 and 91.

Dutch
(See German and Russian)

Earth Sciences (49)
Chairman: Herbert Tischler


ASSOCIATE PROFESSORS: Franz E. Anderson, Henri E. Gaudette, Glenn W. Stewart

ASSISTANT PROFESSORS: Francis S. Birch, Wallace A. Bothner

VISITING ASSISTANT PROFESSOR: Theodore C. Loder

401. Principles of Geology I
The earth and its history. A consideration of land forms and a discussion of the materials and structures of the earth’s crust. Staff. 3 lectures; 1 laboratory; 4 credits. Offered both semesters.

402. Principles of Geology II
The earth and its history continued. The interpretation of past geologic events and their effect on the development of life forms. Staff. 3 lectures; 1 laboratory; 4 credits. Offered both semesters.

409. Environmental Geology
An understanding of geological processes allows man to use the products and forces of nature to exploit and manage his environment and to anticipate some of the unforeseen problems that may arise. Topics to be discussed will include: water resources; geologic hazards, such as landslides, earthquakes, stream erosion, and sedimentation; and land use, site investigations, and the exploitation of natural resources. Mr. Stewart. Prerequisite: Earth Science 401 or permission of instructor. 4 credits.

501. Introduction to Oceanography
Descriptive and regional oceanography covering the physical, chemical, biological, and geological aspects of the sea. Mr. Anderson, Mr. Birch, and Mr. Loder. 3 lectures; 4 credits.

512. Descriptive and Determinative Mineralogy
The physical and chemical properties of minerals, their associations, modes of occurrence and uses, with training in their identification. Mr. Bothner. Prerequisites: Earth Science 401 and Chemistry 401 or 403 passed or taken concurrently. 2 lectures; 2 laboratories; 4 credits.
531. **Structural Geology**
The structural units of the earth's crust and the mechanics of their formation. Mr. Stewart. 3 lectures; 1 laboratory or field work; 4 credits.

561. **Geomorphology**
The factors producing the present aspect of the land surface, particularly that of New England. Special emphasis on the work of running water, glaciers, and marine agents. Field trips during the fall season. Mr. Chapman. 3 lectures; 1 laboratory; 4 credits.

613. **Principles of Mineralogy**
Introduction to crystallography; principles of the physics and chemistry of natural solids; the atomic structures of minerals and their investigation by x-ray diffraction. Prerequisite: one year of college chemistry or permission of instructor. Mr. Schmeer. 3 lectures; 1 laboratory-recitation; 4 credits.

614. **Petrography**
Description and classification of igneous, sedimentary, and metamorphic rocks in hand specimen and thin section; introduction to optical mineralogy. Prerequisite: Earth Sciences 512. Mr. Bothner. 2 lectures; 2 laboratories; 4 credits.

632. **Mapping Techniques and Field Geology**
Training in basic techniques of geologic mapping. Mr. Stewart. Prerequisite: Earth Science 531. 1 lecture; 2 laboratories; 4 credits.

652. **Invertebrate Paleontology**
The classification, evolution, and stratigraphic occurrence of invertebrate animals as recorded by fossils. Field trips will be made to collect specimens and to study environments of living and fossil material. Mr. Tischler. 3 lectures; 1 laboratory; 4 credits.

662. **Glacial Geology**
The characteristics of existing glaciers and an interpretation of Pleistocene glacial features. The abundant and varied evidence of glaciation in northeastern North America and Baltic Europe will be emphasized and New Hampshire examples of both alpine and continental glaciation will be studied in the field. Mr. Chapman. 3 lectures; 1 laboratory; 4 credits.

725. **Igneous and Metamorphic Petrology**
The study of igneous and metamorphic rock series; the application of textural, mineralogical, and chemical analysis, and phase rule and phase diagram interpretation to petrogenesis. Prerequisite: Earth Sciences 613, 614, or permission of instructor. Labs consist of field study and petrographic analysis. Mr. Bothner. 3 lectures; 1 laboratory; 4 credits.

734. **Applied Geophysics**
Theory and application of gravity, magnetic, seismic, electrical, and thermal methods of investigating subsurface geology. Practical fieldwork and use of computers in data analysis. Mr. Birch. Prerequisites: Mathematics 428 passed or taken concurrently, Earth Science 401, one year of college physics, or permission of instructor. 3 lectures; 1 laboratory; 4 credits.

741. **Geochemistry**
Applications of thermodynamics to geological processes; geochemical differentiation of the earth; the principles and processes which control the distribution and migration of elements in geological environments. Mr. Gaudette. 3 lectures; 1 laboratory; 4 credits.
752. Chemical Oceanography
An introduction to the chemistry of the oceans, with emphasis on water structure, chemical composition and equilibrium models, gas exchange, biological effects on chemistry, trace metals, and analytical methods. Laboratory includes short cruise aboard R/V Jere A. Chase. Mr. Loder. Prerequisite: permission of instructor. 3 lectures; 1 laboratory (optional); 3 or 4 credits.

754. Sedimentation-Stratigraphy
The properties of sediments and sedimentary rocks, with emphasis on lithofacies, biofacies, principles of stratigraphic correlation and sedimentary tectonics. Mr. Anderson and Mr. Tischler. 2 lectures; 1 laboratory; 4 credits.

759. Geological Oceanography
Geologic properties of the earth that are unique to the continental shelves and ocean basins. Special emphasis will be placed on submarine geomorphology, eustatic sea-level changes, crustal and subcrustal oceanic structure, and the evolution of the ocean basins. Prerequisite: Earth Science 501 and 754. Mr. Anderson and Mr. Birch. 2 lectures; 1 discussion group; 1 special project; 4 credits.

781. Physical Geology
The materials and structures of the earth and the erosive agents that modify them are described in the lectures and are examined and studied in the laboratory and on field trips. This course is for certified elementary or high school science teachers who need an introduction to the earth sciences. (Not available for credit after completing Earth Science 401 or equivalent.) 4 credits.

782. Historical Geology
The history and development of the physical features of the earth and the development of life on the earth. Fossil organisms will be briefly surveyed in the laboratory and the methods of historical geology will be illustrated in the laboratory and on field trips. Prerequisite: Earth Science 781 or equivalent. This course is for certified elementary or high school science teachers who need an introduction to the earth sciences. (Not available for credit after completing Earth Science 402 or equivalent.) 4 credits.

795. Geological Problems

Special problems by means of conferences, assigned readings, and field or laboratory work, fitted to individual needs from one of the areas listed above. Staff. 2 or 4 credits.

796. Honors Project
Independent research projects similar to Earth Science 795 for students with 3.0 or better, average in Earth Science. Staff. 2 or 4 credits.

797. Geology Colloquium
Study of selected topics in both classical and modern geological thought. Designed for majors. 0 credit. NLG.
Economics (31)
Program Director: William R. Hosek

Professors: Arthur W. Johnson, emeritus; Ruth J. Woodruff, emerita; Robert F. Barlow, Carroll M. Degler, John A. Hogan, Manley R. Irwin, John J. Korbel, Sam Rosen, Kenneth J. Rothwell

Associate Professors: George W. Betz, Allan J. Braff, William R. Hosek, Dwayne Wrightsman; Lawrence Nordell, Visiting

Assistant Professors: Lawrence P. Cole, John V. Donovan, John R. Haskell, Richard L. Mills, Robert C. Puth, Heidimarie Sherman

400. Economic Issues
Application of economic analysis to wide range of current economic issues. Depending on the instructor and the interests of students, such issues as environmental pollution, federal deficit spending, monopoly and waste, poverty and proposals for its alleviation, price and wage controls, the urban crisis, war and the economy, etc., will be discussed in a nontechnical, conceptual framework. Classes organized around student reports on, and discussion of, outside readings. No prerequisites. No credit toward a major or minor in economics. 4 credits.

401 (401). Principles of Economics (Macro)
An introduction to the basic functions of the United States economy viewed as a whole, together with policies designed to affect its performance. The problem of economic scarcity, an introduction to supply and demand, the causes of unemployment and inflation, the nature of money and monetary policy, the impact of government taxation and spending, the federal debt, and issues concerning economic growth. No prerequisites. Not open to students who have had Resource Economics 401. 4 credits.

402 (402). Principles of Economics (Micro)
An introduction to the functions of the component units of the economy and their interrelations. The units of analysis are the individual consumer, the firm, and the industry. The theory of consumer demand and elasticity, supply and costs of production, theory of the firm under conditions of perfect and imperfect competition, the demand for and allocation of economic resources, general equilibrium, and basic principles and institutions of international trade. No prerequisites. 4 credits.

403, 404. Honors Economics (Macro, Micro)
Special seminars in the principles of economics for classes of up to 20 students who are capable of, and interested in, rapidly acquiring sufficient competence in the use of the tools of economic analysis so that pressing contemporary economic problems and issues may be examined in depth and alternative policies considered. Conduct of the course emphasizes student participation and interchange with other students and the instructor. Readings will be selected from popular and technical literature. No formal prerequisites, but permission of the instructor is required. 4 credits.

415. Economic History of the United States
The development of the United States economy from Colonial times to the present. Models of economic development and their applicability to the United States at various times. The role of social, political, and cultural factors in shaping the economy. Development and influence of economic institutions. No prerequisite. 4 credits.
525, (525). Introduction to Economic Statistics
Classical statistical techniques useful in economic science. Includes methods of collection, analysis and presentation of statistical data, introduction to probability theory, statistical inference, regression and correlation analysis, index numbers, and time series analysis. Prerequisite: Mathematics 415 or equivalent. 4 credits.

A multidisciplinary approach to conflicting economic systems and ideologies; income distribution, wealth, and poverty; public policy. Several countries of the world will be considered. Not for major credit. 4 credits.

605, (605). Intermediate Economic Analysis
Analysis of supply and demand. The determination of prices, production, and the distribution of income in non-competitive situations as well as in the purely competitive model. General equilibrium. Prerequisite: Economics 402. 4 credits.

611, (611). National Income Analysis
Macro-economic measurement, theory, and public-policy determination. Prerequisite: Economics 401, 402. 4 credits.

615. History of Economic Thought
The evolution of economic thought, including the work of contemporary economists. Examination and critical appraisal of the work of major economists and major schools of economists, particularly with reference to the applicability of their theories to current economic problems. Prerequisite: Economics 401, 402. 4 credits.

621. Economic Development
An analysis of the problems and available solutions confronting the underdeveloped areas of the world. Prerequisite: Economics 401, 402. 4 credits.

626. Introduction to Quantitative Economics
Development of the concept of a simple testable economic model of either the explanatory or forecasting type. Alignment of the model with reality by means of computer-performed statistical estimation. Discussion of types of error encountered, consequences of such errors, and possible methods of dealing with errors of various kinds. Prerequisite: Economics 525. 4 credits.

630. Comparative Study of Economic Systems
An examination of socialism, communism, capitalism, and modifications of these economic systems, particularly as exemplified by the Soviet Union, China, Yugoslavia, France, the United Kingdom, and the United States. Prerequisite: Economics 401, 402. 4 credits.

635. Money and Banking
An analysis of money, its supply, demand, impact on the economy, and control by the central bank. Prerequisite: Economics 401, 402. 4 credits.

641. Public Finance
Problems and policies of expenditure, revenue, and debt of the public sector. Economic analysis and evaluation of tax systems and governmental fiscal programs. Prerequisite: Economics 401, 402. 4 credits.

645. International Trade
Theory of international trade, foreign exchange, balance of payments, tariffs, and protection. The economic aspects of international relations, with particular reference to recent policies. Prerequisite: Economics 401, 402. 4 credits.
651. Government Regulation of Business
The role of government in economic affairs, with emphasis on mergers, competition, monopoly, and the regulated industries. No prerequisites. 4 credits.

655. Trade Unions and Industrial Management
Trade-union history, philosophy, and policies. Historical development of management attitudes and the attitudes of law and legislation toward unions. Collective bargaining: its nature, purpose, and public policy considerations. Prerequisite: Economics 401, 402. 4 credits.

656. Labor Economics
Application of the tools of economic analysis to the market for labor. Wage determination and wage policy under union and non-union conditions. The determination of factor shares of the national income with particular emphasis on labor's share. Prerequisite: Economics 402. 4 credits.

695-696. Independent Study
Individual study projects of special interest and benefit to the student. Permission to pursue an independent study project is required from Undergraduate Counselor and proposed project instructor. Permission will be granted only to students who have demonstrated unusual individual initiative. 4-12 credits per semester.

711. Economic Fluctuations
The study of recurrent movements of prosperity and depression with emphasis upon causes and public-policy implications. Prerequisite: Economics 611; or permission of instructor. 4 credits.

720. U. S. Economic History
The development of the United States economy from Colonial times to the present. Presentation and application of economic models and interpretation of data are stressed. The influence of capital accumulation, industrialization, foreign trade, monetary factors, and government are considered, with peripheral attention to non-economic factors. Primarily a course in applied economic theory. Prerequisites: Economics 605, 611, or consent of instructor. 4 credits.

721. European Economic History
The development of Western European and Mediterranean economics from medieval times to the Common Market. Presentation and application of economic models and interpretation of data are stressed. Attention is centered on capital accumulation, technology, trade, industrialization, monetary factors, and the role of government, but the influence of non-economic factors is discussed where relevant. Prerequisite: Economics 605, 611, or consent of instructor. 4 credits.

722. Case Studies in Economic Development
An analysis and evaluation of economic development problems and policies in selected countries. Non-economic factors, important as initial conditions and conditioning influences for the process of economic development, are emphasized. Major development-policy areas are studied, and an appraisal of national-planning experience and the prospects for regional cooperation is made. Prerequisites: Economics 401, 402 or consent of instructor. 4 credits.

725. Statistical Theory
The theoretical basis of statistical methods: probability distributions, statistical inference, and decisions. Prerequisite: permission of instructor. 4 credits.
726. **Mathematical Economics**  
An introduction to the principal mathematical techniques and their application in economics. Prerequisite: permission of instructor. 4 credits.

727. **Introduction to Econometrics**  
The application of statistics and mathematics to economics. The formulation of economic models, their measurement, and verification. Prerequisite: permission of instructor. 4 credits.

728. **Statistical Decision-Making**  
The application of probability and statistics to decision problems. The major emphasis is on the Bayesian approach to decisions under uncertainty, which explicitly injects prior judgements of decision-makers and the consequences of alternative actions into the decision-making process. Prerequisite: permission of the instructor. 4 credits.

735. **Advanced Money and Banking**  
Emphasis on central banking, monetary policy, and monetary theory. Study of current problems and developments in banking. 4 credits.

746. **International Finance**  
The international monetary mechanism. Analysis of private and official international capital flows. Instruments and institutions. The multi-national corporation. Exchange rates, adjustment systems, international liquidity, foreign aid. Prerequisite: Economics 401, 402. 4 credits.

750. **Imperfect Competition**  
Extensive survey of firm behavior in imperfectly competitive market forms, such as monopoly and oligopoly. The implications for price and research performance under such market forms are examined and the relevance of the theoretical arguments are assessed by recourse to appropriate empirical studies. Prerequisite: Economics 605 or permission of instructor. 4 credits.

758. **Manpower and Education Planning**  
The flows of human beings within and between the educational and manpower sectors of the economy will be investigated. Such flows will also be related to the flows of goods and services in the industrial sector. Study of the interrelationships of these flows will be directed toward the construction of a computer simulation-model for use in tracing the impact throughout the economy of manpower and educational-planning decisions. Prerequisite: Economics 401, 402 or consent of instructor. 4 credits.

768. **Survey of Urban Economics**  
Introduction to the theoretical and empirical bases for investigating urban economy; a discussion of policy alternatives for the problems of poverty, housing, urban renewal, transportation, local fiscal affairs, and pollution. Prerequisite: Economics 605 or permission of instructor. 4 credits.

798. **Seminar in Economic Problems**  
Special topics in Economics. This course may be repeated. Prerequisite: consent of adviser and instructor. 2 or 4 credits.
Education

Education (61)
Chairman: Gerald J. Pine

PROFESSORS: Everett B. Sackett, dean emeritus; Angelo V. Boy, Roland B. Kimball, Thomas O. Marshall, Carleton P. Menge, Gerald J. Pine


ASSISTANT PROFESSORS: Margaret D. Ackerman, Charles H. Ashley, Veronica M. Blaschak, Ronald P. Curcio, Sidney Eder, Jeanne M. Gardner, Edward J. Lawton, Judith A. Meagher, Marvin A. Seperson

ADJUNCT ASSISTANT PROFESSORS: John R. Cavanaugh, Peter Cimbolic

INSTRUCTOR: Ellen P. Corcoran

LECTURERS: John D. Bardwell, Agnes G. Hohmann, Mary A. Pine, Jean E. Sweeney, Claire W. Wright

PROFESSOR: Richard H. Balomenos, (Mathematics-Education)

ASSOCIATE PROFESSORS: Lewis C. Coffe, (English-Education); John B. Whitlock, (Music-Education); William H. Annis, (Occupational-Education)

ASSISTANT PROFESSORS: Brian T. Jefferson, (Art-Education); Thomas R. Barstow and Nancy C. Rupp, (Physical Education)

INSTRUCTORS: Rebecca A. Huffman, (Biology-Education); Herbert Tischler, (Earth Science-Education); Barbara H. Wing, (French- and Spanish-Education); Elizabeth A. Snell (Home Economics-Education)


(481). An Educational Psychology of Development
The philosophical and psychological principles underlying the process of education. Through a critical examination of human behavior, the student gains self-knowledge and an understanding of principles that affect all men. An analysis of popular novels, autobiographical reports, and technical studies constitute the basis for group thinking and discussion. 4 credits. (Not open to freshmen.)

(575). Philosophy of Education
An introductory philosophical study of the nature, significance, and place of education within the human condition. The fundamental purpose of this course is to help each student begin to work out and articulate his or her own attitude toward the basic issues which lie at the heart of education at all levels. Although this course is open to any undergraduate without prerequisite, it is especially aimed at those students who want to explore or intend to enter the field of education and who seek to broaden their understanding of the purpose and significance of education. 4 credits.

610. Teaching Elementary School Language Arts
Investigation of the processes of oral and written language. Evaluation of abilities and individualization of instruction. Comparison of current procedures and materials for teaching listening, speaking, and writing. (Offered in Division of Continuing Education only.) 4 credits.
611. Teaching Elementary School Social Studies
The objectives, content, methods, and materials for instructing elementary
school children in the social studies. (Offered in Division of Continuing Edu-
cation only.) 4 credits.

612. Teaching Elementary School Mathematics
The objectives, content, methods, and materials for instructing elementary
school children in mathematics. (Offered in Division of Continuing Education
only.) 4 credits.

613. Teaching Elementary School Science
Involvement strategies for elementary science instruction. Inquiry and discovery
approaches will be compared with more conventional methods. Selection and
justification of goals for science instruction will also be treated. A brief survey
of resources available for science teachers, including analysis of current cur-
riculum projects. (Offered in Division of Continuing Education only.) 4 credits.

614. Teaching Elementary School Reading
Investigation of the reading process. Evaluation of abilities and individualiza-
tion of instruction. Comparison of current procedures and materials for teach-
ing reading. (Offered in Division of Continuing Education only.) 4 credits.

(657). Psychology of Human Learning
Analysis of the learner and the learning process based on theory and research
in learning, personality, and social psychology, as a foundation for instruc-
tional theory, methodology, and technology. Concepts and processes will be illus-
trated and applied through discussion, simulation, observation, and laboratory
experiences. 4 credits.

(658). Principles of Teaching
Application of theories of learning studied in Education 657, with emphasis
on process selection, content goals, organization of learning materials, plan-
ning learning experiences, and evaluation procedures. Prerequisite: Education
657. 4 credits.

(659). Principles of Education
An introductory study of the major historical and sociological factors that
have influenced public education in the United States, the conflicts of educa-
tional philosophy, and selected contemporary educational problems of national
significance. Permission of secondary education coordinator required. 4 credits.

(691). Science Curriculum and Instruction
A course to introduce inservice and preservice secondary teachers of physics,
chemistry, earth science, or general science to modern curricula and methods
in the sciences. A survey of some of the contemporary programs of national in-
terest in secondary school science. A variety of goals and methods for teaching
science. 4 credits.

(694). Courses in Supervised Teaching
See page 28 for description of secondary school teacher preparation program.
Supervised Teaching of Physical Education. 6 credits. NLG.
Supervised Teaching of Occupational Education. 6 credits. NLG.
Supervised Teaching of Art. 6 credits. NLG.
Supervised Teaching of English. 6 credits. NLG.
Supervised Teaching of Social Studies. 6 credits. NLG.
Supervised Teaching of Home Economics. 6 credits. NLG.
Supervised Teaching of Foreign Language. 6 credits. NLG.
Supervised Teaching of Mathematics. 6 credits. NLG.
Electrical Engineering

Supervised Teaching of Music. 6 credits. NLG.
Supervised Teaching of Sciences. 6 credits. NLG.

(734). Children's Literature
A consideration of children's books and methods of using them, with emphasis
given to intermediate grades. Practical demonstrations of how to correlate
children's books with various special projects. 4 credits.

741-742. Elementary School Teacher Preparation
A block program, including observation; psychology of learning; principles
of teaching reading, language arts, social studies, mathematics, science, and
other elementary school subjects; student teaching; and a synthesizing seminar.
Prerequisite: permission of the department. 16 credits per semester.

763. Introduction to Educational Media
The role of educational media in the learning process with emphasis on the
curricular integration of the materials and equipment commonly available in
the school library media center. The design and implementation of learning
systems will provide a framework for the development of individual skills. 4
credits.

(785). Educational Tests and Measurements
An introduction to the theory and practice of educational evaluation. Emphasis
given to uses of test results in classroom teaching and student counseling. Intro-
ductive statistical techniques. 4 credits.

(795,796). Independent Study
Open to juniors and seniors only. Must be approved by appropriate faculty
member. 2 or 4 credits.

(797). Seminar in Contemporary Educational Problems
A seminar offered by one or more members of the staff dealing with issues or
problems of special contemporary significance. Normally the seminar will focus
on a problem which has been the subject of recent special study by the staff
member(s). Prerequisite: permission of instructor(s). 4 credits. May be re-
peated for different topics.

Electrical Engineering  (50)
Chairman: Joseph B. Murdoch

PROFESSORS: Leon W. Hitchcock, emeritus; Fletcher A. Blanchard, Robert N. Faiman,
Albert D. Frost, John B. Hraba, Joseph B. Murdoch, H. Richard Skutt, Alden
L. Winn
ADJUNCT PROFESSOR: Sidney W. Darlington
ASSOCIATE PROFESSORS: Ronald R. Clark, Glen C. Gerhard, Filson H. Glanz, Donald
W. Melvin, John L. Pokoski, Kerwin C. Stotz
ASSISTANT PROFESSORS: Anthony K. Newman, Kondagunta Sivaprasad, Michael M.
Stern
INSTRUCTORS: Ernest E. Nichols, Antal A. Sarkady, Charles F. Walker

402. Introduction to Electrical Engineering
A course designed to develop an understanding of the nature of electrical engi-
neering education and practice and to expose the students to ways in which
electrical technology can make meaningful contributions to a better society. Elements of electrical science, computer logic, and computer programming are provided as background for the solution of problems selected and simplified from real life situations. Instruction is by conferences, group discussions, and laboratory work. Prerequisites: Mathematics 427 and Physics 407. Required of Electrical Engineering freshmen. Open to others by permission of instructor. 2 conferences; 1 laboratory or seminar; 4 credits.

501-502. Dynamic Linear Systems I and II
Dynamics of electrical and mechanical linear systems, mathematical modeling, linear-system transient and steady-state analysis, Laplace transforms, Fourier series, frequency response and power. Prerequisites: Mathematics 428 and Physics 407, 408. 2 lectures; 2 recitations; 4 credits each.

503. Electrical Circuit Theory

505. Electronic Properties of Materials and Devices
The nature of the electron, energy levels, energy bonds, and semiconductor materials. Electronic transport properties of conductors and semiconductors, PN junction theory, physics of bipolar and field effect transistors, transistor characteristics and circuit models, thermionic emission and the vacuum tube. Prerequisite: Physics 408, Chemistry 405, Electrical Engineering 502, and Mathematics 527. 4 credits. (Not offered after Sept. 1974.)

509. Electromagnetic Fields
Static and dynamic electric, magnetic and electromagnetic fields. Maxwell's equations, wave equations, plane waves. Prerequisites: Mathematics 527, Mathematics 528, Physics 408. 4 recitations; 4 credits.

510. Linear Electronic Circuits
Theory of operation, analysis, and design of active circuits containing electronic devices. Prerequisite: Electrical Engineering 511. Electrical Engineering majors must take Electrical Engineering 518 concurrently. 4 credits.

511. Nonlinear Electronic Circuits
Active electronic non-linear circuits in the switching mode. Treats analysis and design of both discrete component and integrated circuits. Prerequisite: Electrical Engineering 502. 3 lectures; 1 laboratory; 4 credits.

512. Design of Digital Systems
Fundamental principles involved in the design and analysis of digital systems. Topics include number systems, switching algebra, logical circuits, codes, and an introduction to digital computers. In the laboratory, the students will build systems using modern integrated circuit technology and will have "hands on" experience with a minicomputer. 3 recitations; 1 laboratory; 4 credits.

515-516. Systems Laboratory I and II
Introductory experiments with electrical, mechanical, and electromechanical systems. To be taken concurrently with Electrical Engineering 501-502. 1 credit each.

517. Electrical Laboratory I
Operation and application of instruments used in electrical engineering. Prerequisite: Electrical Engineering 503 taken concurrently and Electrical Engineering 516. 1 laboratory; 1 credit.

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518. Electrical Laboratory II
Experimental investigations in the principles of electrical engineering as applied to electrical devices and systems. Prerequisite: Electrical Engineering 510, 520 taken concurrently, and Electrical Engineering 517. 2 lectures; 2 laboratories; 4 credits.

520. Electromechanical Energy Conversion
Theory and analysis of transformers and electromechanical energy converters. Prerequisite: Electrical Engineering 502 and 509, or 502 and 535. Electrical Engineering majors must take Electrical Engineering 518 concurrently. 4 credits.

533. Electronics and Instrumentation for Engineers
This course is designed for civil and chemical engineering students. Topics covered include DC and AC circuits, electronic devices, power supplies, amplifiers, digital circuits, transducers, and recording systems. Prerequisite: Physics 408, Math 527. 3 lectures; 1 laboratory; 4 credits.

535-536. Electrical Engineering Fundamentals
Circuits, network analysis, principles of electronics, linear models of electronic devices, electronic amplifiers, non-linear devices and applications, digital logic and devices, energy conversion, magnetic fields and circuits, transformers, electromechanics, rotating machinery, feedback, instrumentation. This course is designed for non-electrical engineering majors. Prerequisite: Electrical Engineering-Mechanical Engineering 501-502. 3 recitations; 1 laboratory; 4 credits.

605. Electronic Properties of Materials and Devices
The nature of the electron, energy levels, energy bonds, and semiconductor materials. Electronic transport properties of conductors and semiconductors, PN junction theory, physics of bipolar and field effect transistors, transistor characteristics and circuit models, thermionic emission and the vacuum tube. Prerequisite: Physics 408, Chemistry 405, Electrical Engineering 510, and Mathematics 527. 4 credits.

611. Nonlinear Electronic Circuits
Active electronic non-linear circuits in the switching mode. Treats analysis and design of both discrete component and integrated circuits. Prerequisite: Electrical Engineering 510. 3 lectures; 1 laboratory; 4 credits. (Not offered after Sept. 1975.)

620. Electronics and Instrumentation
A service course for those students not in engineering or physics. No attempt is made to cover the topics in mathematical or engineering detail. Emphasis is placed on making the student aware of problems which he is likely to encounter when using electronic equipment. Proper technique for using electronic instruments is pointed out in classroom demonstrations and laboratory experiments. Topics covered include D.C. and A.C. circuits, electronic amplifiers, grounding and shielding problems, transducers, electronic instruments, schematic reading, transients, noise problems, and digital techniques. No prerequisites except junior standing. 3 recitations; 1 laboratory; 4 credits.

695. (695). Electrical Engineering Projects
A laboratory or advanced study course. Each student will either join one of the department research projects or engage in a project which is in one of the areas of current staff interest. Admission to the course will be limited to those accepted by a staff member. 1-4 conferences or 1-2 laboratories; variable credit.
(701). Applied Electromagnetic Fields
Introduction to Maxwell's equations; boundary-value problems in electrostatics and magnetostatics; plane wave propagation; reflection and refraction in isotropic media; guided wave propagation; rectangular and cylindrical wave guides; simple resonators; elements of micro-wave circuits, linear antennas; aperture antennas, arrays of dipoles; receiving antennas and reciprocity. Prerequisite: Electrical Engineering 509 or equivalent, 3 recitations; 1 laboratory; 4 credits.

706. Advanced Network Theory
Matrices, linear graph theory and the topological analysis of active and passive networks; concepts of natural frequencies and state; formulation and solution of state equations; application of linear graph and state techniques to real-world system problems. Prerequisite: Electrical Engineering 503. 4 credits.

711. Digital Systems
Generalized, systematic, and practical approach to the logical design of digital systems encompassing circuit components, binary arithmetic, Boolean algebra, simplification methods and derivation of input equations in accordance with current digital system strategies. Practical combination circuits and logical arrays are emphasized in both synchronous and asynchronous applications. Logical equivalents are formulated, together with the system aspects of interfacing digital communication systems, wiring, and reliability considerations. Prerequisite: senior status or above within the College of Technology or approval of instructor. 3 recitations; 1 laboratory; 4 credits.

712. Logical Design of Digital Computers
Extension of Electrical Engineering 711 to the design of both general and special-purpose digital computers. The design parameters of input-output, memory, peripheral, arithmetic, and control units are established together with complete design equations for representative digital computers. Analog and hybrid methods are presented together with error-free techniques and a survey of research trends applicable to present and next generation computers. Prerequisite: Electrical Engineering 711 or approval of instructor. 3 recitations; 1 laboratory; 4 credits.

727. Power Systems
An introduction to the modeling and planning of electric power transmission systems. Prerequisite: Electrical Engineering 503. 4 credits.

741. Fundamentals of Acoustics
The development of the acoustic wave equation for air: laws of reflection, refraction, and absorption; characteristics of acoustical sources; measurement of acoustic sources; microphones; measurement of sound level; properties of acoustical materials; ultra-sonics, architectural acoustics. Prerequisites: Physics 408, Mathematics 527. 3 recitations; 1 laboratory; 4 credits.

757. Fundamentals of Communications
Introduction to communications systems, Fourier analysis of signals, amplitude and frequency modulation, detection, digital and sampled-data signals, noise in electrical circuits. Prerequisite: permission of instructor. 3 recitations; 1 laboratory; 4 credits.

758. Communication Systems
Fundamentals of the design of high frequency communication systems. RF amplification, modulators for amplitude and frequency modulation systems, receiving techniques, antennas, free space propagation, propagation character-
Electrical Engineering

istics of the ionosphere. Prerequisite: Electrical Engineering 509, 757 or equivalent. 3 recitations; 1 laboratory; 4 credits.

762. Illumination
Radiation; color and spectra; physics of light production; sources of ultraviolet, visible, and infrared energy; lamp circuitry; control of light; illumination design. The course will be conducted on a seminar basis with each student researching and discussing the above topics and doing a project in the application of visible or near-visible energy in business and industry, education, the ocean, agriculture, medicine, or other areas. 2 or 4 credits.

770. Integrated Circuit Design and Technology
An introduction to the principles of operation, design, processing, and technology of linear and nonlinear integrated circuits. Bipolar and unipolar structures, including surface-controlled devices, will be considered. Related topics will include thin-film hybrid circuit techniques, vacuum technology, opto-electronic devices, and microwave active circuits. Prerequisites: Electrical Engineering 505 and 510. 2 recitations; 2 laboratories; 4 credits.

781. Instrumentation
Analysis and design of instrumentation systems, sensors, circuits and devices for electrical measurement and control, techniques of sampled data telemetry, display, storage, and processing of information. Prerequisite: senior standing in Electrical Engineering or permission of instructor. 3 recitations; 1 laboratory; 4 credits.

782. Control Systems
Fundamental principles involved in the design and analysis of feedback control systems. Topics include stability criterion, time-domain analysis, frequency-domain analysis, and introduction to nonlinear systems. Prerequisite: permission of instructor. 3 recitations; 1 laboratory; 4 credits.

784. Bioelectronics
A study of topics in bioelectronics including biotelemetry, physiological transducers, and modeling. Animal systems such as the nervous system, circulatory system, the ear, and the eye will be studied from an engineering point of view. Prerequisite: Electrical Engineering 510 or equivalent. 4 credits.

(785). Underwater Acoustics
An introduction to the field of underwater acoustics including vibrations, propagation, reflection, scattering, reverberation, attenuation, sonar equations, ray and mode theory, radiation of sound, transducers, and small and large signal considerations. Prerequisite: senior or graduate status with permission of instructor. 4 credits.

786. Introduction to Radio Astronomy
Characteristics of electromagnetic radiation, propagation. Positional astronomy and the radio sky, discrete radio sources, source structure distribution, the sun as a radio source, flare and burst activity, planetary emissions, galactic background, line emissions (Hydrogen, Hydroxyl), quasars, pulsars, techniques of observation and data reduction, radiometry, polarimeters, correlation interferometers, aperture synthesis. Prerequisite: senior or graduate status within College of Technology. 4 credits.

796, (796). Special Topics in Electrical Engineering
New or specialized courses are presented under this listing, on sufficient demand. Independent study can be given under this course title. Prerequisite: permission of instructor. 2 or 4 credits.
English  (62)
Chairman: Robert Hapgood

PROFESSORS: William G. Hennessy, emeritus; Sylvester H. Bingham, emeritus; Robert C. Webster, emeritus; Max S. Maynard, emeritus; Robert Hapgood, William B. Hunter, Edmund G. Miller, Donald M. Murray, Philip L. Nicoloff, John C. Richardson, Thomas A. Williams


INSTRUCTORS: Lester A. Fisher, Andrew H. Merton

LECTURER: Nancy H. Deane

301. Improvement in Writing*
Required of all students whose attainments in the fundamentals of English are found to be unsatisfactory. 3 recitations; no credit. NLG.

302. Improvement in Reading*
Intensive drill in reading skills for six weeks. 3 recitations; no credit; NLG.

303. English as a Second Language
For students to whom English is a foreign language, a course of instruction in speaking, reading, and writing. No credit; NLG.

401 (401). Freshman English
Training to write more correctly and with more force and to read with more appreciation and discernment. The staff of the department, under the direction of Mr. Murray. 4 credits.

402, (402). Freshman Seminars—Approaches to Literature
Intensive study of a specific literary topic, a theme, a genre, a major figure, or a specific period of English or American literature. 4 credits.

501, (501). Expository Writing
The discipline of non-fiction writing. Weekly papers and frequent conferences required. Prerequisite: English 401 or exemption from it. 4 credits.

512. Introduction to American Literature
A survey of American literature from the beginning to the present. Some attention will be paid to methods of presenting this literature to high school students. Open only to English Teaching majors. 4 credits.

513, 514. A Survey of English Literature
513: From the Old English period to 1800. 514: From 1800 to the present. Prerequisite: English 401 or exemption from it. 4 credits.

515, 516. A Survey of American Literature
515: From the beginning of American literature through Whitman. 516: From the Civil War to the present. Prerequisite: English 401 or exemption from it. 4 credits.

*Any student may be recalled and reassigned to an instruction group at any time in his four years of college upon report of any member of the faculty that his work in composition or in reading is deficient.
English

517. An Introduction to Literary Genres
An introduction to literary forms, either traditional (such as lyric, epic, comedy, and tragedy) or modern (such as the novel and short story). The genres studied and their number vary from year to year. Prerequisite: English 401 or exemption from it. 4 credits.

518. The Bible as Literature
The various literary types found in the Bible and a survey of the influence of the Bible on English literature. Prerequisite: English 401 or exemption from it. 4 credits.

519. Introduction to Critical Analysis
An introduction to the basic skills of critical reading and writing. Students will be expected to participate in class discussions and to write frequent short analytical papers. Readings will be in the three major genres—fiction, poetry, and drama. This course is required of all English majors, and should be taken early in their programs. Prerequisite: English 401 or exemption from it. 4 credits.

520. Literature and the History of Ideas
An interdisciplinary study of literary works as influenced and illuminated by the concepts of philosophers, historians, and scientists. Prerequisite: English 401 or exemption from it. 4 credits.

523. Writing of Technical Reports
2 credits.

621-622. Non-Fiction Writing
A workshop course in the writing of non-fiction. Students interested in journalism will be able to practice writing under strict limitations of time and space in this course, which will prepare them for a career in journalism. Other students will be able to practice forms of non-fiction writing in which they are interested. Individual conferences. 4 credits. No prerequisite except permission of instructor. May be repeated for credit with approval of the department chairman.

625-626. Writing Fiction and Poetry
A workshop in the fundamental techniques of fiction and poetry. Individual conferences. Prerequisite: English 401 or exemption from it. Written permission of instructor required for registration. 4 credits. May be repeated for credit with the approval of the department chairman.

651, 652. Comparative World Literature
A comparison of two or more national literatures through movements, genres, motifs, and dominant philosophic and artistic ideas. 4 credits.

695, 696. Senior Honors
Open to senior English majors who, in the opinion of the department, have demonstrated the capacity to do superior work in English. In the first semester the student will examine a series of special literary problems and write a number of short papers. In the second semester, he will investigate independently one or two larger topics and write one or two long papers. Open to seniors by departmental invitation only. May be counted as two courses toward the eight which constitute a major in English. 4 credits.

697, 698. Senior Seminars
Intensive study of specialized topics which vary from year to year. Enrollment in each seminar limited to 15 students. Exceptional juniors may be admitted with permission of instructor and department chairman. 4 credits.
701-702. Advanced Writing of Fiction and Poetry
Workshop discussions of advanced writing problems and readings of students' fiction, poetry, or plays. Individual conferences. Prerequisite: English 625-626 or its equivalent. Written permission of instructor required for registration. May be repeated for credit with the approval of the department chairman. 4 credits.

703-704. Advanced Non-Fiction Writing
A workshop course for advanced students of writing. The course provides a second year of training for those interested in journalism, but it also provides an opportunity for students to practice other forms of non-fiction writing. Individual conferences. Written permission of instructor required for registration. May be repeated for credit with the approval of the department chairman. 4 credits.

705. English Grammar
A review of English grammar including both traditional and contemporary approaches. 4 credits.

706. English Linguistics
A descriptive approach to modern English grammar, emphasizing the insights provided by linguistic analysis. 4 credits.

709. Critical Analysis of Exposition
A course designed especially for the English Teaching major in which students analyze essays and write non-fiction prose. The course will stress a variety of critical approaches and introduce several methods of teaching composition. 4 credits.

710. Critical Analysis of Fiction
A course designed to acquaint the student with a variety of modern approaches to the criticism of fiction, with special emphasis upon developing skills in close analysis of individual works. 4 credits.

711. Critical Analysis of Poetry and Drama
A non-historical, non-genre approach to individual poems and plays with emphasis on the works themselves. 4 credits.

713, 714. Literary Criticism
Major critics from Plato to the present and the chief critical approaches to literature. 4 credits.

(715). Problems in Applied Linguistics
A consideration of such problems as language acquisition in children and adults, bilingualism, and linguistic field methods. 4 credits.

(716). Applied Linguistics
Methods of teaching and learning foreign languages, with background work on theories of language acquisition. The emphasis is on the methodology of teaching English as a second language, but students interested in teaching other languages may do their projects on those languages. 4 credits.

742. Puritanism and the Enlightenment in America
American literature and thought from the Colonial beginnings through the early republic. 4 credits.

743. American Transcendentalists
Emerson, Thoreau, and other transcendentalists. 4 credits.
744. American Fiction to the Civil War
Cooper, Poe, Hawthorne, Melville, and others. 4 credits.

745. American Poetry of the Nineteenth Century
Bryant, Poe, Emerson, Whitman, Dickinson, and others. 4 credits.

746. American Realism and Naturalism
Twain, Henry James, Adams, Stephen Crane, Dreiser, and others. 4 credits.

747, 748. American Fiction and Drama of the Twentieth Century
Fitzgerald, Hemingway, O'Neill, Faulkner, and others. 4 credits.

749. American Poetry of the Twentieth Century
Robinson, Frost, Stevens, Pound, Eliot, Jeffers, Hart Crane, Robert Lowell, and others. 4 credits.

751. History of the English Language
A study of the evolution of the English language, with special emphasis upon the relation between linguistic change and literary style. 4 credits.

753. Old English
An introduction to Old English language and literature through readings of selected poetry and prose. 4 credits.

754. Beowulf
A reading of the poem and an introduction to the scholarship. Prerequisite: English 753. 4 credits.

755, 756. Chaucer

757-758. Shakespeare
757: surveys a number of representative plays; 758: studies a few plays more intensively. 4 credits.

759. Milton
Milton's life and times, all his poetry, and a selection of his prose. 4 credits.

763, 764. English Literature in the Sixteenth Century
763: Major literary figures of the continental Renaissance (in translation), including Petrarch, Machiavelli, Ariosto, Rabelais, Montaigne, Cervantes, and Erasmus; major English writers of the period, including More, Skelton, Wyatt, and Surrey. 764: A study of Sidney, Spenser, and other non-dramatic poets and prose writers of the Elizabethan period. 4 credits.

765, 766. English Literature in the Seventeenth Century
765: Major writers of prose and poetry in the first half of the century; special emphasis upon the relationships between the "metaphysical" and the "classical" modes of poetry. 766: Restoration comedy of manners, heroic drama, verses satire; Dryden, Milton, and Bunyan. 4 credits.

767, 768. English Literature in the Eighteenth Century

769, 770. The English Romantic Period
769: Wordsworth, Coleridge, Lamb, Hazlitt, DeQuincey. 770: Byron, Shelley, Keats. 4 credits.
771, 772. Victorian Prose and Poetry
771: Carlyle, Mill, Ruskin, Newman, Tennyson, and Browning. 772: Arnold, Clough, the pre-Raphaelites, Swinburne, Hopkins, Hardy, Housman, and others. 4 credits.

773, 774. British Literature of the Twentieth Century
773: Survey of the novels of the period. 774: Survey of the poetry of the period. 4 credits.

781, 782. Introduction to English Drama
The development of English drama, exclusive of Shakespeare, from the Middle Ages to the present. 781: From the Middle Ages to the closing of the theatres in 1642. 782: From the Restoration to the present. 4 credits.

783. The English Novel of the Eighteenth Century
The rise and development of the novel through study of selected major works by Defoe, Richardson, Fielding, Smollett, Sterne, and Austen. 4 credits.

784. The English Novel of the Nineteenth Century
Representative novels from among the following authors: Austen, Scott, Dickens, Thackeray, Emily Bronte, Charlotte Bronte, Trollope, George Eliot, Hardy, and Conrad. 4 credits.

791-792. English Education—Problems in the Teaching of High School English
Principles and methods of teaching literature, composition, and language in secondary schools. Required of all students in the English-teaching major. Open to English majors with permission of instructor. 2 credits. No credit toward the English major.

795, 796. Independent Study
Individual guided study in special topics. Open to highly qualified juniors and seniors both semesters but for a maximum of 4 credits. To be elected only with permission of the department chairman and of the supervising faculty member or members.

797, 798. Special Studies in Literature
Entomology

Entomology (20)
Acting Chairman: G. Thomas Fisher

PROFESSORS: Walter C. O’Kane, emeritus; James G. Conklin, emeritus; Robert L. Blickle

ASSOCIATE PROFESSORS: G. Thomas Fisher, R. Marcel Reeves,

ASSISTANT PROFESSOR: James S. Bowman

400. Insects: Their role as man’s greatest competitor
What are insects? Their role in the environment as it relates to man and his sphere of activities. Open to any student. Not to be used for major credit. Mr. Fisher. 2 lectures; 4 credits.

(402), 402. Introductory Entomology
An introduction to entomology in its broad aspects. The structure, biology, and classification of insects. This course is adapted to students contemplating a major in entomology, in wildlife management, or in the fields of biology or biology-education. Each student is required to make an insect collection. Open to any student. Staff. 3 lectures; 1 laboratory; 4 credits.

503. Principles of Economic Entomology
The nature of insect damage. The methods of insect control, Quarantine and regulatory measures. Natural control. Applied control measures. Open to any student. Mr. Bowman. 3 lectures; 4 credits.

506. Forest Entomology
Structure and development of insects. Orders and families of insects of importance to foresters. Principals of insect control. Biology and control of representative forest insects. Each student is required to make an insect collection. Adapted especially for forestry majors. Open to any student. Mr. Reeves. 3 lectures; 1 laboratory; 4 credits.

704. Medical Entomology
Insects and arachnids in relation to public health. The more important disease carriers, their biologies, and means of control. Adapted especially for students interested in public health or medicine. Mr. Blickle. Elective for juniors and seniors. 2 lectures; 1 laboratory; 4 credits.

707, 708. Advanced Entomology
Insect anatomy, insect ecology, and systematic entomology. Required of entomology majors. Open to others by permission of instructor. R 1. Taxonomy; R 2. Morphology; R 3. Aquatic Insects; R 4. Insect Physiology. Mr. Blickle and Staff. 2 lectures; 14-hour laboratory; 4 credits.

709, 710. Advanced Economic Entomology
Studies in the specialized phases of entomology. This course is structured to meet the objectives of the individual student. R 1. Agricultural Entomology; R 2. Biological Control of Insects; R 3. Chemical Control of Insects; R 4 Regulatory Entomology; R 5. Structural Pest Control. Mr. Fisher and Staff. Required of entomology majors. Open to others by permission of instructor. Hours to be arranged. 2 or 4 credits.
Environmental Conservation
(See Institute of Natural and Environmental Resources)

Forest Resources
(See Institute of Natural and Environmental Resources)

French and Italian
Chairman: Jack R. Vrooman

Professor: Louis J. Hudon
Associate Professor: Jack R. Vrooman
Visiting Associate Professor: Edna S. Hudon
Assistant Professors: Rose T. Antosiewicz, Lydia L. Crowson, Grover E. Marshall
Instructor: Robert M. Davis

French (63)
New students will be assigned to proper courses on the basis of their scores on the College Board Achievement test and on departmental placement tests given at the first meeting of each course. All courses in the department are conducted in French unless otherwise noted. Junior and senior non-majors may write papers and examinations in English in courses numbered 600 and above. French 605-606 is the first course counting toward a major. Students educated in French-speaking countries may not register for courses below the 700 level. Transfer credit will not be given for elementary level college courses in foreign languages if the student had two or more years of the foreign language in secondary school.

401-402. Elementary French
For students without a previous knowledge of French. Development of basic skills in aural comprehension, speaking, writing, reading. 5 recitations. Students will not be permitted to retain credit for French 401 without passing French 402. Laboratory attendance as required. 4 credits. (May not be taken for credit by students who had two or more years of French in secondary school.)

501. Intermediate French
Similar to French 503, below, but for students whose preparation does not qualify them for French 503. This course prepares students for French 504. Completion of this course satisfies the Bachelor of Arts foreign language requirement. 5 recitations; laboratory attendance as required; 4 credits.

503-504. Intermediate French
Intensive reading of complete texts, formal review of grammar, training in oral and written expression of ideas. 3 recitations; laboratory attendance as required; 4 credits.

505-506. Introduction to French Literature and Thought
Reading, discussion, and written analysis of major works in French literature. (Not open to students who have had French 503-504.) 3 recitations; 4 credits.

(514), 514. French Grammar and Speech
Thorough review of grammar and practice in oral and written expression. Prerequisites: French 504 or 506. (May be taken concurrently with 506.) 3 recitations; 4 credits.
French and Italian

605-606. Readings in French Literature
Intensive readings in French literature from the Middle Ages to the present day. Outside readings on the historical and cultural background of the works read. Open to students who have received a grade of C or better in French 504 or 506. 3 recitations; 4 credits.

685-686. Junior Year at Dijon University
A program of studies at the University of Dijon (France) for juniors who have completed their sophomore year at the University of New Hampshire and have passed with a grade of B or better French 605-606 and French 514. Students interested in the program are expected to take courses in French in both their freshman and sophomore years. The students chosen for the program will be required to attend orientation sessions during the second semester of their sophomore year. Interested students should consult with the director of the program, Professor Louis J. Hudon. Not offered for graduate credit. Students not majoring in French must obtain the permission of their major department. 32 credits.

(741). French Literature of the Middle Ages
Readings in the epic, lyric poetry, and the romance. Prerequisite: French 606. 4 credits. (Alternate years.)

(742). French Literature of the Renaissance
Readings in the literature of the sixteenth century. Prerequisite: French 606. 4 credits. (Alternate years.)

759-760. French Literature of the Seventeenth Century
Readings in the literature of the seventeenth century. Prerequisite: French 606. 4 credits. (Alternate years.)

761-762. Eighteenth Century French Literature and Thought
Readings in the Age of Enlightenment. Prerequisite: French 606. 4 credits. (Alternate years.)

767-768. Nineteenth Century French Literature
Readings in Romantic, Parnassian, and Realistic literature of the century. Prerequisite: French 606. 4 credits. (Alternate years.)

(770). Introduction to Modern French Poetry
Studies in French poetry from Baudelaire to the present. Prerequisite: French 606. 4 credits. (Alternate years.)

781-782. Contemporary French Novel and Theater
Readings in the French novel and theater of the twentieth century. Prerequisite: French 606. 4 credits. (Alternate years.)

790. Advanced Language and Style
Translation of literary texts, intensive study of the principal techniques of style, explication de textes. Open to qualified students who have had a minimum of two courses in French numbered 741 and above. 4 credits.

791. Problems of Teaching French
Teaching methods, materials, devices, and an introduction to linguistics as applied specifically to the problems of teaching French. Examination of the goals and organization of French programs in American schools. Observation of classes in the local school system. For prospective teachers of French at pre-college levels. Prerequisites: French 605-606 and 514 or its equivalent. 4 credits. No credit toward a major.
795-796. Special Studies in French Language and Literature
Individual guided study in special topics, with training in bibliography and organization of material. Examples of topics which may be selected are: the work of a major French author, specific topics in any area of French literature. Prerequisite: permission of the department chairman. Variable credit.

798. Seminar in French Literature
A study of French authors chosen by the instructor. Prerequisite: French 606, 4 credits.

Italian (64)
New students will be assigned to the proper course upon consultation with the department. Students educated in Italian-speaking countries may not register for courses below the 700 level. Transfer credit will not be given for elementary level college courses in foreign languages if the student had two or more years of the foreign language in secondary school.

401-402. Elementary Italian
For students without a previous training in Italian. Development of basic skills in aural comprehension, speaking, writing, reading. 5 recitations; laboratory attendance as required. 4 credits. (No credit for Italian 401 without Italian 402.) (May not be taken for credit by students who had two or more years of Italian in secondary school.)

503-504. Intermediate Italian
A complete review of the fundamentals of grammar and syntax. Selected readings intended as a general introduction to Italian civilization and culture. 3 recitations; laboratory attendance as required; 4 credits.

795, 796. Independent Study in Italian Language and Literature
Individual guided study in special topics in any area of Italian literature. Prerequisite: permission of the department chairman. Variable credit.

Geography (65)
Chairman: William H. Wallace

Professor: William H. Wallace
Assistant Professors: Robert G. LeBlanc, Robert L. A. Adams

401, 402. Regional Geography of the World
A survey of the geography of the world, organized in terms of the major culture areas of the earth. Geography 401 considers the areas of Western culture—Europe and the New World countries of the Americas and Australia and New Zealand. Geography 402 is concerned with the study of Non-Western culture areas—Black Africa, The Dry World, Oriental Asia, and the Pacific. In each area the unique integration of human and physical phenomena that produces the distinctive character of the region is studied. 4 credits.

473, (473). The Weather
Interpretation of atmospheric phenomena; heating and circulation of the atmosphere; nature and movement of air masses influencing the weather of North America, especially New England. Explanation of day-to-day weather changes
as they occur by graphic analysis, including practical or applied meteorology. 2 lectures; 1 laboratory; 4 credits. (Does not satisfy the Social Science requirement.)

511. Geography of Anglo-America
A regional and topical analysis of the United States and Canada. Physical features and human phenomena are studied in the context of their contributions to the character of the area. 4 credits. (Alternate years.)

531. Geography of Western Europe and the Mediterranean
A regional and topical analysis of the geography of Western Europe and the Mediterranean region. Major topics studied include the patterns of natural phenomena, cultural features, and economic systems. 4 credits. (Alternate years.)

532. Geography of the USSR and Eastern Europe
A systematic analysis of the Soviet Union and the Communist Bloc countries of Eastern Europe with an emphasis on the former. Topics include natural regions, population, ethnography, agriculture, manufacturing, transportation, and trade. The contemporary pattern of population and the location of economic activity are viewed from the perspectives of historical process, the physical resource base, and the economic ideology of Communism. 4 credits (Alternate years.)

(571), 572. Physical Geography
A systematic study of the geography of the earth in terms of climates, landforms, vegetation, and soils. Geography 571 is concerned with the study of weather and climate. Landforms, vegetation, and soils, and the integration of physical features in selected areas are studied in Geography 572. 2 lectures; 1 laboratory; 4 credits. (Alternate years.) (Does not satisfy the Social Science requirement.)

581. Cultural Geography
An analysis of the geographic pattern of mankind. The differentiation of the world in terms of population, race, language, religion, and economy. Emphasis is placed on the historical origin and the diffusion of these phenomena as well as their significance in understanding the contemporary culture map of the world. 4 credits. (Alternate years.)

582. Economic Geography
An analysis of the areal variation of the earth in terms of man's production, exchange, and consumption of economic goods. Agriculture, extractive industries, manufacturing, trade, transportation, and various tertiary activities are studied in terms of their location, their development, and their interaction with related phenomena. Emphasis will be placed upon the development and application of various theories of location. 4 credits. (Alternate years.)

590. Introductory Cartography
An introduction to cartography. This course, through lectures and laboratory projects, is designed to develop an awareness of map usage, to develop an appreciation and understanding of the principles of map design, and to acquaint the student with some of the problems of map execution. Emphasis is placed upon special purpose thematic maps of the type commonly used in scholarly papers, theses, journals and books. The course is project-oriented, involving, although not presupposing, some elementary knowledge of statistics. Two lecture-laboratory sessions. 4 credits.

610. The Geography of New England
An intensive study of the geography of the New England region. Major themes are the distinctive physical setting of New England, its settlement and develop-
ment during the past three centuries, and the present-day problems and opportunities of the region. Two field excursions will be held on weekends near the end of the term. 4 credits. (Alternate years.)

670. Climatology
The study of the climates of the world. A knowledge of the basic meteorological processes is assumed. Major topics studied include: the atmospheric circulation and its effect upon climates, climatic change, and the problems of climatic description and classification. Most of the course is devoted to the analysis of the climatic characteristics of the major regions of the world. Prerequisite: Geography 473 or Geography 571 or permission of instructor. 4 credits. (Alternate years.) (Does not satisfy the Social Science requirement.)

783. Historical Geography of the United States
The spatial analysis of Indian economic life in 1492 and of European exploration, colonization, population change, economy, urbanization, and ethnicity to 1900. Occasional focus on the development of geographic illusions and their significance. 4 credits. (Alternate years.)

795, (795). Special Project in Geography
The study of special problems in geography by means of readings, library, archival, and field work. This course is intended primarily for seniors majoring in geography. Prerequisite: permission of instructor. 2 or 4 credits.

797. Seminar in Geography
The methodology and philosophy of geography. The course deals with the history of geographic thought, the organizing concepts of the discipline, and the approaches to geographic analysis. The definition and investigation of research problems from the geographic perspective. Primarily for seniors majoring in geography. 4 credits. NLG.

Geology
See Earth Sciences, Page 163.

German and Russian
Chairman: Guenter Herr

ASSOCIATE PROFESSORS: Marron C. Fort, Helmut Pfanner
ASSISTANT PROFESSORS: Alexander P. Danoff, emeritus; Guenter Herr, Frank R. Jacoby, Michael J. Rosenbush, James L. Sherman

German (66)
New students will be assigned to the proper course on the basis of their scores on the College Board Achievement test. Transfer credit will not be given for elementary level college courses in foreign languages if the student had two or more years of the foreign language in secondary school.
German and Russian

401-402. Elementary German*
For students without previous knowledge of German. Aural-oral practice and the study of fundamental speech patterns, reading and writing to achieve a firm basis for an active command of the language. No credit toward a major. 4 recitations; required laboratory; 4 credits. (May not be taken for credit by students who had two or more years of German in secondary school.)

403-404. Elementary Dutch*
An introduction to the language of the Netherlands and Flemish Belgium. Aural-oral practice and the study of fundamental speech patterns to achieve a firm basis for an active command of the language. 4 recitations; 1 laboratory; 4 credits. (May not be taken for credit by students who had two or more years of Dutch in secondary school.)

405-406. Reading Knowledge of German*
For students without previous knowledge of German. This course is primarily for those students of natural sciences, who wish to develop a reading comprehension of German. There is a minimum of aural work but sufficient aural practice to aid in the understanding of a German lecture. Basic grammar is covered rapidly, followed by selected readings of German scientific texts with concentration on comprehension and translation to English. No credit toward a major. 5 recitations; 4 credits. (May not be taken for credit by students who had two or more years of German in secondary school.)

422. Elementary German: Accelerated*
For students without previous knowledge of German. The course intends to utilize the advantages of a strictly monolingual approach and to achieve in only one semester the goals normally set for a full year's course. 8 recitations; 8 credits. (May not be taken for credit by students who had two or more years of German in secondary school.)

501-502. Intermediate German*
A systematic review of German grammar and syntax. Practice in oral and written expression. Successful completion of German 501 satisfies the Bachelor of Arts foreign language requirement. 3 recitations; required laboratory; 4 credits.

507-508. Intensive Intermediate German*
This course is designed for students who have demonstrated superior ability in German 401-402. Prerequisite: a grade of A in German 402 or permission of instructor. Intensive practice in written and oral expression. The language of instruction is German. 3 recitations; 1 laboratory; 4 credits.

601-602. Advanced Language and Style
This course, which is essential for all students intending to engage in study or research in a German-speaking country, is designed to develop native facility in the use of spoken and written German. Treatment of a wide range of topics in essays and oral reports. 3 recitations; required laboratory; 4 credits per semester.

605-606. Introduction to German Literature
Reading and analysis of works selected from the most important periods in German literature. Outside readings on the historical and cultural background of the works read. Papers and discussion in German. Term paper in English. This course or its equivalent is prerequisite to all higher literature courses in German and is required for German majors. 4 credits.

* A student educated in a foreign country will not be permitted to register for any German or Dutch course on the 400 and 500 level if German or Dutch is the student's native language.
621-622. German in Translation
Major works by German writers of the last two hundred years, with emphasis on German contributions to the European tradition. Authors such as Grass, Brecht, Hesse, Mann, Kafka, Rilke, Büchner, Heine, Hoffmann, Schiller, Holderlin, Lessing, Goethe. Readings, discussion, papers in English. Does not count for German major. 4 credits.

685-686. Junior Year in Salzburg
A program of studies at the University of Salzburg (Austria) for students of colleges and universities in New England who have completed their sophomore year and have passed a minimum of four full courses in German with a grade of B (3.0) or better and have an over-all grade average of C+ (2.5). Students participating are expected to attend a four week non-credit orientation seminar in Salzburg prior to the beginning of the fall semester. This program is open to all students regardless of major. Interested students should consult the Director, Studies Abroad Program. Variable to 32 credits.

693-694. Readings in German Literature
Intensive readings of selected novellas, poems, and plays from the nineteenth and twentieth centuries. The course is intended as an introduction to the interpretations of literary texts and will emphasize questions of interpretation and literary form. Conducted in German. 4 credits.

695-696. Honors Work in German
For seniors writing a research paper in the honors program in German. Prerequisite: permission of department chairman. 4 credits.

726. German Culture and Civilization
A survey of the historical, social, artistic, and folkloristic developments in German-speaking countries from the beginnings to the present. 4 credits.

741. German Lyrics from Gryphius to George
A critical survey of German lyrics including problems of prosody and poetics. 4 credits.

742. History of the German Drama
A study of the changes in dramatic form from “Peter Squenz” to “Marat/Sade.” 4 credits.

743. Introduction to Middle High German
The phonology and grammar of Middle High German. The reading of selected texts. 4 credits.

744. Medieval Literature
German literature from the earliest monuments until 1500. Longer works will be read in modern German translation. 4 credits.

751-752. The Civilization of the Low Countries
A survey of the literature, art, history, and social structure of the Netherlands and Flanders from the beginnings to the present. This course is conducted in Dutch and English. 4 credits.

755. Renaissance and Baroque
Literature of the sixteenth and seventeenth centuries, including works by Brant, Marner, Luther, Fischart, Biedermann, Opitz, Gryphius, Lohenstein, Grimmelshausen. 4 credits.
Russian

756. Literature of the Enlightenment
Literature and criticism of the eighteenth century, including Gottsched, the Swiss critics, Lessing, Wieland, and the “Sturm und Drang.” 4 credits.

757-758. The Age of Goethe
Goethe, Schiller, Hölderlin, Kleist, and their times. 4 credits.

762. German Romanticism
German literature from 1780-1830. Critical analysis and interpretation of prose, drama, and poetry from Wachenroder to Eichendorff. 4 credits.

771. German Post-Romantic Literature
A study of the works of Grillparzer, Mörike, Stifter, Heine, Büchner, and of other writers of “Biedermeier,” “Junges Deutschland,” and “Vormärz.” 4 credits.

772. The Age of Realism
The outstanding prose and lyrics of Keller, Meyer, Storm, Fontane, and others. 4 credits.

777. Bibliography and Methodology
Tools and methods of bibliographical research with an introduction to the techniques of literary interpretation. 4 credits.

781. History and Development of the German Language
The changes in the sounds, structure, and vocabulary of the German language from the earliest record to the present. Required for German majors. 4 credits.

785. German Literature from Naturalism to Expressionism
Major literary movements between 1880 and 1925 including such authors as Hauptmann, Wedekind, Mann, Hesse, Kafka, Rilke, Benn. 4 credits.

786. German Literature from 1918 until 1948
The literature of Germany between the two World Wars as well as German exile literature including Brecht, Doeblin, Zuckmayer, Musil, Broch, Graf, and others. 4 credits.

791. Methods of the Teaching of German
A critical study of modern language teaching at all levels from the elementary school through college. The course emphasizes the use of the most modern equipment, including films, tapes, and other audio-visual aids. 4 credits.

795, 796. Special Studies in German Culture and Civilization
Independent and in-depth investigation of a vast range of subjects; barring duplication of material, may be repeated for credit; assumes a sound background in Germanic studies. 1-4 credits.

Russian (67)

New students will be assigned to the proper course on the basis of their scores on the College Board Achievement test. Transfer credit will not be given for elementary level college courses in foreign languages if the student had two or more years of the foreign language in secondary school.

401-402. Elementary Russian
Elements of Russian grammar. Oral practice and written drills designed to achieve a mastery of grammatical patterns. Reading of graded prose. No credit toward a major. 5 recitations; 2 laboratories; 4 credits. (May not be taken for credit by students who had two or more years of Russian in secondary school.)
501-502. Intermediate Russian
   Review of Russian grammar. Reading of prose and practice in oral and written
   expression. Open by placement examination and to students who have passed
   Russian 402 with a grade of C or better. 4 recitations; 1 laboratory; 4 credits.

605-606. Introduction to Russian Literature
   Readings of selections from Russian literature. Discussion and composition
   based on the texts read. Prerequisite: Russian 502 with a grade of B, or Russian
   502 with a grade of C and permission of instructor. 4 credits.

622. Russian Literature in Translation
   Readings of major works of Russian literature of the last 150 years as repre-
   sented by Pushkin, Gogol, Tolstoy, Dostoevsky, Solzhenitsyn. Readings, discus-
   sion, papers in English. 4 credits.

795-796. Special Studies in Russian Language and Literature
   Courses of study in selected topics in Russian language and literature. 4 credits.

Greek
(See Spanish and Classics)

History (68)
Chairman: Douglas L. Wheeler

PROFESSORS: William Yale, emeritus; Thomas N. Bonner, H. Trevor Colbourn, William
   Greenleaf, Hans Heilbronner, Charles A. Jellison, William R. Jones, David F.
   Long, Darrett B. Rutman
ASSOCIATE PROFESSORS: Gibson R. Johnson, emeritus; Allan B. Partridge, emeritus;
   Charles E. Clark, Robert C. Gilmore, Marion E. James, Marc L. Schwarz, Douglas
   L. Wheeler, Donald J. Wilcox
ASSISTANT PROFESSORS: Thomas M. Kemnitz, Allen B. Linden, Frank D. McCann,
   Robert M. Mennel, John O. Voll

   Lower-division (500-level) courses are primarily designed for freshman and
   sophomore students; upper-division (600-700-level) courses are primarily for junior
   and senior students.

   Students are not permitted to enroll concurrently in survey courses and ad-
   vanced courses of the same area. Nor are they eligible to enroll in elementary courses
   after having completed advanced courses in the same area. Exemptions from this rule
   are possible only through petition.

Basic Course
   The following course is recommended for students who desire a general intro-
   duction to the study of history.

501, 502. World History
   A historical analysis of the fundamental developments in human societies from
   the Paleolithic Age to the present. Special effort is made to view history from
   a world perspective and to analyze social and cultural as well as political fac-
   tors of the human experience. 4 credits.
Group I. American History

503, 504. History of the United States
American history from settlement to the present. Political, social, economic, and diplomatic aspects. 4 credits.

505, 506. Afro-American History
A survey of experiences, aspirations, and contributions of black Americans from their ethnic origins in Africa to the present American crisis in race relations. The historical method and constructive criticism will be applied in this course in order to arrive at knowledge about America's black people. Extensive reading of available sources will be encouraged. 4 credits.

703. The Colonial Period of American History
Anglo-America from the late sixteenth century to the mid-eighteenth century, encompassing a general and interpretative view of the development of an Anglo-American culture along the eastern seaboard of North America. 4 credits.

704. The Sources and Methods of Colonial American History
An introduction to the materials and methodology of the historian of Anglo-America, structured around a series of problems underlying the interpretations considered in History 703, specific approaches to these materials, and what historians have done with the materials. Prerequisite: History 703 and (for graduate students) permission of instructor. 4 credits.

705, 706. America in the Eighteenth Century and the Revolution
American colonial and revolutionary history during the period from 1740 through the adoption of the Constitution and the establishment of Washington's first administration. 4 credits.

711, 712. Nineteenth-Century America
The historical factors, both domestic and international involved in the development of the American Republic, its institutions and people, from the inception of the new nation in 1789 to the emergence of the United States as a world power in 1900. 4 credits.

715, 716. Twentieth-Century America
United States history since 1896, from the triumph of industrialism on the national scene to the emergence of America as world power in the nuclear age. Political, economic, and diplomatic developments. 4 credits.

719, 720. The Foreign Relations of the United States
Primarily the history of American diplomacy, with attention given to the non-diplomatic aspects of foreign relations. 4 credits.

721, 722. History of American Thought
An examination of the ideas, considered in their social context, of significant American thinkers. First semester, 1600 to 1860. Second semester, 1860 to the present. 4 credits.

723. American Historiography
An examination of the principal writings of American historians from the Colonial period to the present time. Emphasis will be given to those works that pertain mainly to the American people and their immediate neighbors. Prerequisite: permission of instructor. 4 credits.

724. American Urban History
The development of urban society in America from Colonial times to the present. Lectures will also explore the comparative histories of European and American cities. 4 credits.

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725, 726. Afro-American History
Basic historical problems, with reference to the economic, political, and social conditions of black Americans, from the early slave-trade period to recent radical confrontations and the Black Power movement. 4 credits.

Group II. European History

535, 536. Modern European History
Europe from the end of the Middle Ages to the present. The evolution of the national state; international relations; the expansion of Europe overseas; and the background of modern Western civilization especially its ideas, literature, and art. A basic course for those who wish to proceed further in the study of European history as well as a survey for those who are interested in special aspects of Western cultural development. 4 credits.

559, 560. History of England
The history of the British Isles from earliest times to the present, and a consideration of the British Empire and Commonwealth of Nations. A parallel to English literature, a background to American political history, and a study of English culture and institutions in the democratic and social integration of the world. 4 credits.

739, 740. Three Medieval Civilizations
A study of the demise of classical antiquity in the lands bordering the Mediterranean and the genesis and fruition of three new cultural traditions: the Latin Christian, the Islamic, and the Byzantine. Stress will be put on religious, literary, and scholarly survivals and innovations from 400 A.D. to 1400 A.D. 4 credits.

741. The Age of the Renaissance
The Renaissance from 1300 to 1600. The course will stress intellectual and cultural history and will concentrate on events in Italy, though aspects of the Renaissance in northern Europe will also be covered. 4 credits.

742. The Age of Reformation
The course will cover the period from 1300 to 1600 in northern Europe, stressing the intellectual and cultural aspects of the European Reformation. While the course will concentrate on the events of the sixteenth century, important trends in the fourteenth and fifteenth centuries will be given considerable attention. 4 credits.

749. The Age of Revolution
Revolution as a socio-political phenomenon in its historical setting. Comparative approach to Puritan, American, and French revolutions with reference to contemporary movements. 4 credits.

751, 752. European Intellectual History
The development of the European intellectual tradition from the Greek philosophers to the end of World War II. Emphasis is on the way in which basic ideas have developed out of previous modes of thought in response to new challenges. 4 credits. (Offered in alternate years.)

756. Twentieth Century Europe
The background of World War I, the interwar period, the rise of European totalitarianisms, World War II, and the attempts to solve the conflicts of modern society in the post World War II period. 4 credits.
History

(759). History of Modern Spain and Portugal
The Iberian states and their peoples from the coming of liberalism to the present. Why Iberian liberalism and liberal government failed to triumph will be a featured theme. Political and social change will be emphasized as well as imperial and intellectual movements. In the study of two modernizing countries with persistent traditions, influences of Western European thought and activity will be included. (Seminar format.) 4 credits.

761, 762. England in the Tudor and Stuart Periods
An examination of the political, religious, socio-economic, and intellectual forces for change at work in England from the accession of Henry VII to the Revolution of 1688-89. 4 credits.

763, 764. History of Russia
The development of the Russian state from its foundation to its present status as a world power. The course is designed to increase the understanding of the present in terms of the past. Political developments, foreign relations, and intellectual and ideological currents. 4 credits.

767, 768. History of Germany
Germany and the various German states from the Reformation to the Third Reich and the presently divided Germany. The course will emphasize the relationship and importance of Germany to the rest of Europe. 4 credits.

771, 772. Modern England
The history of England from 1760 to the present. Emphasis is placed on the social, intellectual, economic, and political transformation of the country as it developed into a major industrial nation. 4 credits.

774. European Historiography
The development of historical writing from the Greeks to the twentieth century. The course will stress means of evaluating various types of historical writing, the intellectual context of the historians considered, and the effect of this on their work. Readings will be from selected historians. The course is neither a methodology course nor one in the philosophy of history and these problems will not be directly treated. 4 credits.

Group III. Non-Western History

531, 532. Latin-American History
First semester deals with Amerindian America and the European conquest and domination down to the last half of the eighteenth century. Second semester examines problems of identity, integration, and nationalism, with analysis directed at selected national areas (e.g., Brazil, Mexico. Argentina, and Cuba) plus attempts at generalization. 4 credits.

575. The Ancient Near East
A history of the Near East from the neolithic revolutions to the time of Alexander the Great. Special attention will be given to the rise of civilization, the nature of man's artistic and intellectual development in the earliest civilizations of Mesopotamia and Egypt, and Judaism in its historical setting. 4 credits.

576. The Aegean World
A history of the Aegean area from Crete to the death of Alexander the Great in 323 B.C. 4 credits.

579, 580. The History of China and Japan
A two semester survey of the civilizations of China and Japan from their origins to the present. The goal of the first semester is to study aspects of the traditional
civilizations of China and Japan. Students will consider such topics as the evolution of the Chinese imperial system and the development of feudalism in Japan, the dominant religions of China and Japan, and the literature and arts of the two civilizations. In the second semester the modernization of China and Japan from around 1800 to the present is the principal theme. The growth of nationalism in China and Japan, the rise of communism in China, and the development of Japan as a modern industrial state are among the topics of concern. 4 credits.

585, 586. The History of the Middle East
The history of the Middle East from the time of Muhammad to the present. The first semester covers the origins and expansion of Islam and the nature of medieval Islamic civilization. The second semester covers Ottoman history, relations with European powers, and the emergence of modern nations in the Middle East. 4 credits.

587, 588. History of Africa South of the Sahara
Africa from ancient times to the present. First semester: from prehistoric times to 1860. Second semester: from 1860 to the present. Topics analyzed will include African migrations, kingdoms and societies, African responses to the slave trade, Islam, European imperialism and colonialism, and industrialization. African nationalism, independence, and post-independence problems will be studied. 4 credits.

731. Latin American History: Regional or Country Studies
The history of a specified region or country; directed research papers will be required. History 531-532 is recommended but not required. See the department listing for the semester topic. 4 credits.

732. Latin American History: Topical Studies
A thematic course in which directed research papers will be required. History 531-532 is recommended but not required. See the department listing for the semester topic. 4 credits.

777, 778. The Hellenistic-Roman World
The history of the Mediterranean and the Near East from the death of Alexander the Great to the collapse of the Roman and Persian Empires (fifth to seventh centuries A.D.) The course will cover the main political and social developments of the area, but will give most consideration to artistic, scientific, philosophical, and religious trends, with particular emphasis on the rise of Christianity, Zoroastrianism, and the general religious climate that prepared the way for Islam. 4 credits.

(781). History of Modern China, 1850-1950
The modernization of China. The political, social, and cultural changes which have occurred in China from its early contacts with the West to the establishment of the Communist regime. 4 credits.

784. History of Southern Africa Since 1820
The struggle for political and economic control in the only region of Africa where European groups remain in power. With special attention to the development of European hegemony, the course will trace the impact of European imperialism, European settler nationalism, racial conflict, economic competition and industrialization, Apartheid, and Assimilation. Included will be a discussion of official American policy in this region. 4 credits.
History

785. The Modern Middle East
A history of the Middle East from the eighteenth century to the present time, with special attention given to the problems created by modernization and reform of the traditional society, the conservative reaction to reform, the impact of nationalism, and the appearance of new ideologies. 4 credits.

(787). Black Consciousness and Protest
A survey of the origins and cause of the rising consciousness and consequent activism of the peoples of Negro descent in the New World and in Africa from the early nineteenth century to the present. Will include lectures, discussions, and panels on protest literature, black nationalism, Pan-Negroism, Pan-Africanism, *negritude*, the Nation of Islam, and separatist religious sects in the Americas and Africa. The framework of the course will be cross-cultural and multi-disciplinary. 4 credits.

(793). Advanced World History
History from the perspective of the experience of the whole human community. The histories of separate areas will be examined in terms of their relationship to the general historical experience of man. Problems of interpretation, interrelationships, similarities, and differences in the development of the major traditions of civilization. Students will present oral and written reports as a basis for discussions. Prerequisite: permission of instructor. 4 credits.

Group IV. Special Courses

521. History of Science (to the Renaissance)
Prehistoric techniques, Pythagoreanism and Greek rationalism, the concept of the universe, neo-Platonism and the Newtonian synthesis, history of atomism. 4 credits.

522. History of Science (Post Renaissance)
The idea of the past, evolution; matter, energy, light; the rise and decline of classical physical science, history of relativity and the quantum theory. Prerequisite: History 521 or permission of instructor. 4 credits.

(697). Colloquia for Senior History Majors
Intensive study of selected historical subjects in seminar or colloquium. Topics and instructor to be announced each year. Open only to history majors. This course is required of all history majors and it is expected that they will take this course during their senior year. Juniors may be admitted with the permission of the instructor. May not be repeated for credit except with the permission of the department. Offered both semesters annually. Depending on the particular subject, may be used to satisfy major requirements in American, European, or non-Western history. 4 credits.

(789). Seminar in the History of Science
Selected topics, conducted through special lectures, individual study, oral and written reports. The subject will vary from year to year. Cannot be used for credit in history without permission of the history department. Prerequisite: permission of adviser and instructor. 4 credits.

790. Quantification and Computers for the Historian
An introduction to the historian's use of computers and statistics stressing the practical applications of both interactive terminal operations and batch processing. Students will be exposed to data generation and processing, computer languages (*BASIC, FORTRAN*), programming and library programs, terminal and batch procedures, elementary statistics; will undertake operations of their own on material supplied; and will consider particular quantitative studies in

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history in terms of techniques used. No previous knowledge of computers or college mathematics required. Prerequisite: admission as an undergraduate major or graduate student in history or permission of instructor. 4 credits.

791. History-Education—Problems in the Teaching of High School History and Other Social Studies
Bibliography and new interpretations of history; the social studies curriculum, past and present; aims and objectives in the social studies; selection and organization of teaching material; teaching and testing techniques. Special emphasis on teaching American history and the problems of American democracy. This course may not be used to satisfy major requirements. 4 credits.

795, 796. Independent Study
Students showing a special aptitude in history who desire to study an area or subject for which no appropriate course is offered may undertake an independent study project in that area. In order to register for independent study, the student must obtain the permission of his major adviser and a member of the faculty who agrees to supervise his study. 4 or 8 credits.

(797). Colloquia in History
Selected topics in American, European, and non-Western history. Open to advanced undergraduate and graduate students. Prerequisite: permission of instructor. Depending on the particular subject, may be used to satisfy the major requirements in American, European, or non-Western history. 4 credits.

Home Economics (22)
Acting Chairman: Elizabeth A. Snell

ASSOCIATE PROFESSORS: M. Elizabeth Rand, Mary E. Holder, Elizabeth A. Snell
ASSISTANT PROFESSOR: Linda C. Boehme
INSTRUCTORS: Carol D. Courser, Victor R. Messier, Linda Schomaker

307 (307). Workshops
Supervised, non-credit workshops to develop skills in areas of individual need. A student may enroll in a workshop at any time it is scheduled in order to achieve the degree of skill desired. There may be some expense involved for materials. Limited to home economics majors. 1. Basic Clothing Construction, 2. Tailoring, 3. Basic Food Preparation, 4. Creative Activities for the Young Child, 5. Interior Design. No credit.

407, (607). Professional Seminars
Designed to help the student define and clarify professional and educational objectives, to become acquainted with the philosophy, focus, and issues in home economics and with professional opportunities in the field. A student may enroll in the first half of the course in the freshman or sophomore year and the second half in the junior or senior year. Field trips and guest speakers will be an integral part of the course. HE 407: fee for field trips, $10. 2 credits each semester, NLG.
Home Economics

(418), 418. Food Preparation
Fundamental principles of food preparation and service, including meal planning. Application of these principles through laboratory experiences. Prerequisite: home economics major. Laboratory fee $9. 2 credits.

506. Principles of Nutrition
A study of the fundamental principles underlying the nutrition of man and animals; the functions of the various nutrients in the maintenance, growth, and production of the animal body and the metabolic disorders resulting from their deficiency; the digestion, absorption, intermediary metabolism, and excretion of individual nutrients will be discussed within this framework. Mr. Repka. Prerequisite: Human Physiology and some knowledge of organic chemistry. (Also offered as Animal Science 506.) 3 lectures; 1 laboratory; 4 credits.

507, (507). Introductory Field Experience
A supervised experience in the community which provides opportunity for students to explore various careers opportunities in nursery schools, day care centers, cooperative extension, programs for the handicapped, youth groups, schools, community and family welfare agencies, hospitals, and others. Prerequisite: home economics major and permission. One or more semesters. 2 or 4 credits.

514. Textiles
Factors which affect the acquisition and use of clothing and textile products. Special consideration given to textile fiber and fabric properties, producer-retailer-consumer interrelationships, and the textile industry. Laboratory and field trips fee, $9. 4 credits.

525, (525). Human Development
An examination of theories concerning the development and guidance of the child from conception through aging. Each student will have the opportunity to select an area he/she may wish to pursue in depth. It is suggested that Psychology 401 and Sociology 400 be taken previous to or concurrently with this course. 4 credits.

531, (531). Environmentics
A study of the physical, social, and psychological aspects of the environment in terms of user-needs. Application to a problem in practical analysis. 4 credits.

557, (557). Consumer Education
The role and responsibility of the consumer in contemporary society. An examination of the decision-making framework through which the consumer may acquire skills in identifying and evaluating alternative choices in an increasingly complex market system. Emphasis on influences of the larger environment as it affects and is affected by consumer choice-making. Student-developed problems will focus on some of the current social and economic issues that affect the lives of individuals. Field trips fee, $8. 4 credits.

573. Human Nutrition
The basic principles of nutrition and their application in meeting nutritional needs during the various stages of the life cycle. 4 credits.

575. Normal and Therapeutic Nutrition
The functions, acquisition, and utilization of essential nutrients and the relation of nutrition to health during the various stages of the life cycle with some consideration of the dietary treatment of certain diseases. Prerequisite: permission of instructor or nursing major. 3 lectures; 4 credits.
583, (583). The Young Adult
Relevant issues as identified by the students will be investigated through guided reading, guest lecturers, small group discussions, and individual projects. 4 credits.

615. Specialized Clothing Construction
The interrelationship of methods, processes, and techniques involved in pattern designing, and advanced clothing construction. Laboratory experiences are provided for application of and experimentation with selected principles. Prerequisite: Home Economics 307, exemption test, or permission of instructor. 4 credits.

(626), 626. The Young Child
Normal development and behavior with emphasis on the research concerning infancy and early childhood. The student will design and conduct an individual study with young children. Prerequisite: Home Economics 525 or equivalent. 4 credits.

627, (627). Creative Activities in Preschool Programs
An exploration of how needs of young children are met through creative activities. The focus will be an appreciation and understanding of the creative process and guidance of activities as a basis of curriculum development in preschool programs. The student will observe and participate in preschool programs. Prerequisite: Home Economics 525, home economics major, or permission of instructor. 4 credits.

657, (657). Management and Decision Making in the Family
An examination of family concepts and their application to the management dynamics of family decision-making. Opportunities will be provided for direct experience in family situations. 4 credits.

671. Introduction to Food Science
Introduction to the experimental study of food, application of the principles underlying food preparation, and experimentation in comparative food preparation. Prerequisite: Home Economics 418 or equivalent and some knowledge of organic chemistry. Laboratory fee $8. 2 lectures; 2 laboratories; 4 credits.

674. Quantity Food Purchasing and Production
Principles and methods of quantity food purchasing and production. Laboratory experiences in University dining halls. Prerequisite: basic food preparation and permission of instructor. 4 credits.

683, (683). Family Relations
An examination of theories and supporting research concerning dynamics and patterns of interaction, role behavior, and development in families in specific. Prerequisite: a course in the behavioral sciences. 4 credits.

685. One Semester at the Merrill-Palmer Institute
A junior or senior student in the Department of Home Economics may attend the Merrill-Palmer Institute in Detroit, Michigan, for one year or one semester.

695, (695). Independent Study
A student who has shown special ability in a selected area of home economics may, with department approval, elect to work on a problem of special concern in the area of her choice. Regular conferences with an adviser are required. Prerequisite: department permission: One or more semesters. 2 or 4 credits.
(696), 696. Field Experience
Field work for one semester with an agency, institution or organization concerned with the welfare of families and individuals. The student will plan this experience with the department adviser and apply for approval for the field work. The student will live in or near the community in which he/she is working and will pay regular University tuition. Approval will depend on recommendation of faculty members and the interest and commitment of the student. Limited to home economics juniors or seniors. Not more than 16 credits.

707, (707). Practicum with Children and Families
A planned supervised experience with children or families at both participating and observing levels. The practicum is designed to increase the students' awareness and understanding of the ways human beings grow and behave and the dynamics of the family. Weekly discussions will be combined with individual and small group supervisory conferences. Students have the opportunity to choose a focus for their practicum from among the following areas: 1. Young children, e.g., preschool program; 2. School-age children; 3. Adolescents; 4. Children and parents; 5. Low-income families, e.g., management experiences. Prerequisite: home economics major and permission. One or more semesters. 2 or 4 credits, maximum of 6 credits in one area.

709. Biochemistry of Nutrition
An in-depth study of the intermediary metabolism of nutrients with emphasis on energy metabolism. Coverage includes transport mechanisms; biological oxidations; interrelationships of carbohydrate, fat, and protein metabolism in normal and abnormal states; obesity and control of hunger and appetite. Mr. Repka. Prerequisite: college course in biochemistry. (Also offered as Animal Science 709). 3 lectures; 1 laboratory; 4 credits.

(715). Clothing in Relation to Human Behavior
The analysis of research and theory in the social psychological aspects of clothing. An exploration and study of clothing behavior of individuals and groups. Special emphasis given to stages of the life cycle, development of the self, and the phenomenon of fashion. 4 credits.

725. Preschool Programs
The organization and operation of programs for young children. Theoretical knowledge about children and educational techniques will be related to the curriculum, facilities, and administration in a variety of group programs for young children. Field trips will be planned. Prerequisite: home economics major or permission of instructor. 4 credits.

754. Personal and Family Finance
Major financial alternatives available to families during the various stages of the family life cycle. 4 credits.

757. Consumer Problems
A model for analyzing consumer problems from the perspective of family, business, and government interests. The application of theoretical knowledge to the solution of consumer problems. Prerequisite: 3 credits in consumer studies and permission of instructor. 4 credits.

774. Clinical Dietetics
Application of principles of normal nutrition to clinical problems with description of altered nutrient requirements in human disease. Diet therapy as an applied aspect of clinical nutrition is considered. Prerequisite: Home Economics 506, a college course in biochemistry, or consent of the instructor. 3 lectures; 1 laboratory; 4 credits.
(776). Nutrition—A World View
The major nutritional problems facing the world today. Consideration of protein-calorie malnutrition, obesity, nutritional status of adolescents, and special nutritional problems of pregnancy, infancy, childhood and the aging. Use of the scientific literature to examine methods of assessing nutritional needs, nutritional status, and problems of current national and international interest. Prerequisite: Home Economics 506, 573, 575, or consent of the instructor. 4 credits.

(786). Dynamics of Family Change
An examination of the theories and supporting research of the intervention techniques used to affect changes in family behavior. The secondary focus is the student's examination of his interaction processes and their effect on intervention efforts. Prerequisite: Home Economics 683. 4 credits.

791, (791). Methods of Teaching Family Life and Home Economics
Home economics education in the school program, curriculum materials, methods, and resources in teaching home economics and family life. Offered each semester as part of the secondary student-teaching Block Program and as an independent course in alternate years. 4 credits.

793. Sex Education in Home, School, and Community
An exploration of human sexuality and of programs, materials, and methods for sex education in the home, school, and community. Intended for students planning careers in teaching, nursing, or social work. Prerequisite: permission of the instructor. 4 credits.

Hotel Administration (32)
Program Director: Mel Sandler

ASSOCIATE PROFESSORS: Richard H. Pew, Mel Sandler
ASSISTANT PROFESSOR: Frank Bucci
ADJUNCT ASSISTANT PROFESSOR: Barry D. Kaplan

403. Elements of Institutional Administration
The various components of the services sector with emphasis upon the lodging and feeding segment. Laboratory experience enhances the understanding of production-service facilities and personnel performance. 4 credits.

518. Financial Analysis and Controls
A specific approach to the unique controllership of the lodging and feeding industries, demonstrating concern for perishable commodities as related to the personal nature of production and service, time factors, and the mobile characteristic of the customer. Prerequisite: Administration 517. 4 credits.

556. Management of Physical Structures
Stresses analysis of the components of physical structures as functional units through logical development of principles rather than application of formulae and rigid rules. The concept of building management is presented as demonstrating the interdependence of planning, construction, equipment, maintenance, personnel, and the customer. 4 credits.
Humanities

655. Management for Transient, Leisure, and Institutional Services
Feasibility planning, development, financing, and organization of facilities. Rate-structure determination, i.e., analysis of demand as against variable costs of operation and fixed-cost considerations, such as the economic life of structures. Case studies provide observation of production and cost functions, human motivation, and institutional behavior, with the customers present. 4 credits.

666. Markets and Promotion of Public Services
Aspects of the services market with emphasis on consumer behavior. Internal and external stimulation of sales in competitive and non-competitive markets, and the vagaries of environmental concept. Experimental techniques embodied in industry sponsored sales-blitz activities. 4 credits.

667. Functional Management
Experiences in organizational behavior within the framework of functional services. The responsibility of management is assumed in various roles involving marketing, promotion, sales, production, personnel, and customer attitudes. 4 credits.

695. Independent Analysis
An independent study and research project for honor students performed for the advancement of knowledge in the lodging and feeding fields. Prerequisite: senior standing and permission of instructor. 4 credits.

698, (698). Seminar
Special topics in hotel and institutional management. In-depth exploration of developments related to the service industries augmented by use of case studies. Prerequisite: Hotel Administration major with senior standing or consent of adviser and instructor. Course may be limited to 20. 4 credits.

Humanities (69)
Courses Coordinated by the Chairman of the Humanities Division, College of Liberal Arts

501-502. Humanities
A course in general education sponsored by the departments of the Humanities Division. It aims to develop an appreciation of literature, the visual arts, and philosophy, and to provoke further study into the roots of Western civilization. Some of the authors studied in 501 include Homer, the Greek Tragedians, Plato, Aristotle, the Stoics, the Bible, and Virgil. In 502, Dante, Castiglione, Machiavelli, Cervantes, Montaigne, Racine, Molière, Pope, Goethe, Wordsworth, Flaubert, Zola, Tolstoi, Ibsen, and Chekhov, as well as the most important developments in Western art. Weekly lecture series, slides, films, and visits to Boston museums. Open to freshmen. 4 credits.

503. Humanities of the Twentieth Century
A course in general education sponsored by the departments of the Humanities Division. It continues the aims and methods of Humanities 501-502, but it focuses on the literatures, philosophies, and arts of Western civilization in the last hundred years. Prerequisite: Humanities 502 or, with permission of instructor, another course in the history of literature, philosophy, or the arts. 4 credits.
595. Special Studies in the Humanities
Subjects of interdisciplinary interest in the humanities, sponsored by the departments of the Humanities Division. The subject will vary from semester to semester. The course may be repeated for credit. 4 credits.

699. Senior Project in Humanities
Independent work under a faculty advisor culminating in a senior project. Open only to senior Humanities majors. 2, 4, or 6 credits.

Institute of Natural and Environmental Resources
Director: Otis F. Hall

ASSOCIATE PROFESSORS: James P. Barrett, Owen B. Durgin, Nicholas Engaliechew, Bennett B. Foster, Edmund F. Jansen, David P. Olson, Nobel K. Peterson, M. Marcel Reeves, Oliver P. Wallace, Silas B. Weeks, Richard R. Weyrick
ASSISTANT PROFESSORS: Robert D. Harter, William W. Mautz, Douglas E. Morris, Roger P. Sloan
ADJUNCT PROFESSOR: George E. Frick
ADJUNCT ASSOCIATE PROFESSORS: C. Anthony Federer, William B. Leak, Nelson L. LeRay, Robert S. Pierce
ADJUNCT ASSISTANT PROFESSOR: Peter W. Garrett

Institute of Natural and Environmental Resources (27)

511. Computation Methods in Natural Resources
Principles and practice in computer programming using basic and FORTRAN on remote terminals. Solution of forestry and other natural resource problems. Staff. No credit if Math 403 is taken. 1 lecture; 1 laboratory; 2 credits.

528. Applied Statistics I
Development of elementary statistical techniques through the analysis of prepared data. Topics reviewed include numeric scales; continuous and discreet probability distributions; distributions of sample statistics; small-sample theory; elementary analysis of variance; regression; correlation, their non-parametric analogues; and chi-square. Mr. Durgin. 2 lectures; 4 credits.

581. Methods in Land Surveying
An applied course in principles and field methods of land surveying for the natural resource manager. Principles of measurement of distance, direction, and elevation. Instrumentation and computation, legal aspects of land description and boundary. Mr. Jenkins. Prerequisite: Forest Resources 542 or permission of instructor. 2 lectures; 1 4-hour laboratory; 4 credits.

635. Contemporary Conservation Issues
Man's technology, applied to the wildland renewable resources, causes biological and social conflicts because men's objectives, relative to these resources, differ. Game, timber, water, minerals, and soil contribute to economic growth but this growth places conflicting demands on our eco-systems. Elective for all
Institute of Natural and Environmental Resources

students except freshmen and forestry majors. Mr. Wallace, Mr. Bruns. 3 lectures; 4 credits.

676. Economics of Water Use and Quality Management
Water use is economically assessed in current and prospective institutional framework. Includes role of government and policy agencies, water supply and demand, economic impact of water and water quality standards, alternatives in quality management, externalities, and methods of evaluation. Mr. Andrews. Prerequisite: Elementary biological or physical science (or Soil and Water 504) and elementary economics. Two 1½-hour lectures; 4 credits.

702. Natural Resources Policy
Contemporary issues in the management and allocation of natural resources. The impact of human activity and demands on resources, including agricultural and forest lands, water, wildlife, fisheries, and minerals. Historical perspective as it contributes to an understanding of current public and private resource policies. Prerequisite: permission of instructor. Mr. Bruns, Mr. Weyrick, Mr. Bowring, Mr. Drew. 4 credits.

709. Soils and Community Planning
A “Town Plan” and a soils map are studied by students to develop individual reports of land use. Introduction to the soils of New Hampshire, basic information on the U.S.D.A. soil classification system, and the Soil Conservation Service criteria for rating soils for multiple use: housing, recreation, sewerage, effluent disposal, conservation, transportation, surface runoff, and other soil-use problems common to rural and urban communities. A representative of a town-planning firm and federal and state soil scientists are guest lecturers. Mr. Peterson. 2 lectures; 2 credits.

711. Statistical Methods II
An intermediate course in statistics. Topics include basic concepts of sampling, linear models and analyses for one-way and multiway classification, factorial arrangement of treatments, multiple regression, and covariance. Computer programs used. Prerequisite: Forest Resources 528 or equivalent. Mr. Barrett. 2 1½ hour seminars; 1 laboratory; 4 credits.

712. Sampling Techniques
A study of the techniques of sampling a finite population. Topics include choice of sampling unit and frame, estimation of sample size, confidence limits, and comparisons of sample designs. Prerequisite: Forest Resources 528 or equivalent. Mr. Barrett. 2 1½ hour seminars; 1 laboratory; 4 credits.

735. Pollution of Water: Causes and Control
A combination of individual study and guided classroom discussion to explore problems in environmental pollution. Major emphasis is on the scientific and technological aspects of pollution and pollution control. Topics include the sources, effects, and control of water pollution; as well as its social, economic, and legal implications. Mr. Harter. Prerequisite: senior or graduate standing. Two lectures and weekly papers. 4 credits.

758. Remote Sensing
Imaging with photographic and non-photographic sensors. Emphasis is on the interpretation of aerial photography and on conventional photogrammetric techniques. Applications of remote sensing to resources management, including forestry, agriculture, geology, engineering, wildlife, and land-use planning. Transportation fee. Field and indoor laboratory work arranged to fit the disciplinary interest of the student. Mr. Bruns. 3 hours lecture; 3-hour laboratory; 4 credits.
797. **Forest Recreation Seminar**

The recreational use of forest lands. Economics of public and private developments. Planning for state and local recreational use, emphasizing social aspects. Prerequisite: junior standing and permission of instructor. Mr. Wallace. Two 11/2 hour sessions; 4 credits.

**Forest Resources (21)**

425. **Dendrology**

The identification, classification, and silvical characteristics of trees and shrubs in autumn and winter. An introduction to plant taxonomy, ecological succession, and plant geography. The principal forest regions of North America. Required of freshmen in forestry and wildlife. A class transportation fee is charged. Mr. Mautz. 2 lectures; 2 laboratories; 4 credits.

426. **Wood Technology**

Introduction to microstructure; physical, chemical, and mechanical properties; and seasoning and preservation of wood. Identification of commercially important timbers and wood quality evaluation. A class transportation fee is charged. Mr. Hill. 6 hours per week; 4 credits.

527. **Silvics**

The ecological basis of silviculture; classification of forest communities; environmental factors and their influence on forest vegetation; influence of vegetation on environment. A class transportation fee is charged. Prerequisite: Botany 411, Forest Resources 425 or Botany 506, Soil and Water Science 501 taken concurrently. Mr. Hocker. 3 lectures; 1 laboratory; 4 credits.

542. **Forestland Surveying**

Forest and land measuring equipment and techniques, preparation of maps, public land survey, courthouse deed search. Two-week field session in June. A class transportation fee is charged. Mr. Foster. 2 credits.

544. **Forest Economics**

Economics involved in the supply and demand for forest products, services. Forestry and the general economy, economics of the firm, forest valuation, taxation. Prerequisite: Principles of Economics. Mr. Foster. 3 hours of lecture; 2 hours of laboratory; 4 credits.

629. **Silviculture**

The theory and techniques of applying ecological knowledge to the control of establishment, composition, and growth of forest stands for economic purposes. A class transportation fee is charged. Prerequisite: Forest Resources 425 and 527. Mr. Hocker. 2 lectures; 2 laboratories; 4 credits.

634. **Wildlife Ecology**

The biological principles and human factors affecting wildlife and fish populations, and an introduction to the theory and practice of wildlife management. Includes a survey of common fish and wildlife species, research problems, and management techniques. Prerequisite: a basic course in biology, botany, or zoology, or consent of instructor. A class transportation fee is charged. Mr. Olson, 2 lectures; recitation; laboratory; 4 credits.

644. **Forest Biometrics**

Application of mathematical, statistical, and computer techniques in forest resource measurements and inventory. Course includes area sampling, point
sampling, and photogrammetric techniques. A class transportation fee is charged. Prerequisite: calculus, computer techniques, and Forest Resources 542. Mr. Barrett. 2 1/2 hour seminars; 1 laboratory; 4 credits.

660. Forest Fire Protection
Principles and techniques of forest fire prevention, behavior, and effective control. Weather phenomena related to fire and other aspects of forest damage. Fire effects and use. Transportation fee. Prerequisite: Forest Resources 527 or 629, Soil and Water 501. Mr. Weyrick. 2 lectures; 1 laboratory (10 weeks of semester); 2 credits.

672. Ecological Energetics
Processes and phenomena involved with the flow of energy through ecological systems. Basic concepts and laws of thermodynamics and their application to biological systems which include both animals and plants; photosynthesis; respiration; trophic structures; productivity; and ecological efficiency. Man's use of energy, present and future, and his effects on energy flow in the ecosystem. Prerequisite: An ecology course or permission of instructor. Mr. Mautz. 3 lectures; 1 laboratory; 4 credits.

695, 696. Investigations in Forestry

720. Forest Tree Improvement
The genetics of forest tree improvement with emphasis on variation in natural populations, the basis for selection of desired characters, and the fundamentals of controlled breeding. The application of principles will be directed toward silviculture, management, and utilization. Prerequisite: permission of instructor. Mr. Hocker. 3 lectures; 1 laboratory; 4 credits. (Alternate years; offered in 1973-74.)

737. Game Management I
Biological characteristics, habitat usage, research, and management techniques of upland game birds and big game mammals. Students should be prepared for weekend field trips to wildlife areas in New England. Transportation fee. Prerequisite: wildlife management major or permission of instructor. Mr. Olson. 2 lectures; 1 recitation; 1 laboratory; 4 credits.

738. Game Management II
Biological characteristics, habitat usage, research and management techniques of small game mammals, furbearers, and waterfowl. Students should be prepared for weekend field trips to wildlife areas in New England. Transportation fee. Prerequisite: wildlife management major or permission of instructor. Mr. Olson. 2 lectures; 1 recitation; 1 laboratory; 4 credits.

745. Forest Management
Production control in forests with many uses and management objectives. Problems in forest production regulation and economic analysis. Practice of forest administration. Professional responsibilities and opportunities. Prerequisite: completion of junior year in forestry curriculum. A class transportation fee is charged. Mr. Weyrick. 3 lectures; 1 laboratory; 4 credits.
753. Operations Control and Analysis
Control and analysis of forest-based operations. Quantitative development of cost functions. Mathematical programming, PERT, game theory, simulation, scheduling. Transportation fee. Prerequisite: Forest Resources 544 and 644. Mr. Foster. 3-hour lecture; 3-hour laboratory; 4 credits.

754. Wood Products Manufacture and Marketing
The wood products manufacturing industry from harvesting and procurement of raw material to finished product processes with emphasis on management decisions, marketing, and promotion problems. Visits to harvesting operations and manufacturing plants in New England. Transportation fee. Prerequisite: Forest Resources 426. Mr. Hill. 3 lectures; 1 laboratory; 4 credits.

764. Forest Industry Economics
Application of business methods and economics in the establishment and operation of a forest industry; planning for minimum cost operations and the profitable use of capital in a forest enterprise. Prerequisite: senior standing and permission of instructor. Mr. Wallace. 2 one-hour sessions; 1 laboratory; 4 credits.

798. Forest Resources Management Seminar
Population trends and human needs in relation to forest land productivity for timber, wildlife, water, recreation, and grazing. Class organized for group planning to maximize forest productivity for our society. Prerequisite: Forest Resources 745. Mr. Wallace. 2 lectures; 2 laboratories; 4 credits.

Resource Economics (25)

401. Macro and Environmental Economics
Introduction to aggregate economics and tools to solve environmental economic problems. Economic scarcity, inflation, unemployment, monetary and fiscal policy, taxation, and economic growth are studied during first ten weeks. Remainder of semester is on external costs; use and misuse of resources; and relationships among economic growth, environmental quality, and policies to reduce pollution. Mr. Jansen and Mr. Morris. (No credit if Econ. 401 has been taken.) 4 credits.

402. Economics of Resource Use and Growth
The roles of labor, capital, and technology in growth and development. The economics of food production, food marketing, and consumer decision-making. National policy for food prices, land use, and resource development. Mr. Henry. 3 11/2-hour lectures; 4 credits.

501. Agricultural Business
Structure, organization, and performance in the U. S. agricultural business sector. Major emphasis is placed on agricultural commodity marketing systems. Demand estimation, pricing policies, consumer characteristics, and related topics. Problems and case materials are used. 3 lectures; 4 credits.

504. Management of Farm and Related Resource-Based Business
Planning, operation, and control of farms in the institutional environment of commercial agriculture. Emphasis is on organizing the farm firm; planning adjustments, use and analysis of records, and taxation. Laboratory experience in budgeting changes, analyzing alternatives, estimating credit needs, and farm appraisal. Prerequisite: Economics 402 or Resource Economics 402 or permission of instructor. 2 lectures; 1 laboratory; 4 credits.
506. Population, Food, and Resource Use in Developing Countries
The economic, technical, cultural, social, and political factors that influence food supplies, resource use, income distribution, and growth potentials in the developing countries. The solution of population and food problems is given emphasis. Specific topics include: the population explosion; strategies for expanding food supplies; social and institutional constraints; strategies and policies for economic development. Mr. Jansen. 3 lectures; 4 credits.

507. Introduction to Community Problems
Major social problems of communities as they adjust to external changes. Institutions, trade, political control, and taxation form a framework for use by planners and background for further studies. Mr. Bowring, Mr. Weeks. 4 lectures; 4 credits.

508. Applied Community Development
This course provides students with an opportunity to work in an actual community situation to learn how to apply the various concepts and principles that have relevance in community development. Emphasis is on assisting individuals and groups in communities in identifying needs and problems, establishing attainable and objective goals, assessing requirements and resources, and formulating programs for development. Methods of collection, analysis, and integration of pertinent primary and secondary economic, social, political, and physical data for community development are covered. Mr. Weeks and Mr. Jansen. Prerequisite: Resource Economics 507 or permission of instructor. 3 lectures; 4 credits.

701. Applied Statistics I
Use of elementary statistical techniques in analysis of prepared data. Topics surveyed include elementary probability; discrete and continuous probability distributions; distributions of sample statistics; small-sample theory; elementary analysis of variance, regression, correlation; chi square; and non-parametric analogues of regression and analysis of variance. Mr. Durgin. 3 lectures; 4 credits.

705. Structure and Planned Change in Non-urban Communities
Community economic growth, relative to employment, income, transportation, housing, expenditures, and public services. In context of planning. Class projects provide involvement in community development activities. Mr. LeRay. Prerequisite: Resource Economics 508 or permission of instructor. 4 credits.

706. Economics of Resource Development
The classical and modern theories of economic development. Economic problems of land and resources in relation to market location, urban-rural conflicting demands, and conservation and water supply. Population mobility, capital needs, and the roles of public and private leadership will complete the framework for discussion of the major resource development problems of New England. Mr. Bowring. Prerequisite: Economics 401. 4 credits.

707. Research Methods in Social Science
The scientific method of research. Analysis of research problems in social sciences. The design of research and the application of research techniques to identifying and solving problems. Can be used in place of Sociology 702. Mr. Drew. Prerequisite: three hours of statistics. 4 credits.

715. Linear Programming Methods
Setting up and solving problems by the simplex and distribution methods; variation in linear programming methods with applications, nonlinear program-
ming, and solving input-output and game-theory problems. Applications to firm and aggregate economic analysis. Mr. Andrews. Prerequisite: Mathematics 420 or equivalent. 4 credits.

717. Law of Community and Regional Planning
A review of the law pertaining to community and regional planning; the common law, the Constitution, and the powers of the executive, legislative, and judicial branches with respect to property law including eminent domain, land-use planning, urban renewal, zoning, environmental protection laws, housing, and building codes, etc. Designed to make the non-lawyer aware of the influence and operation of the legal system in communities to enable him to deal with competing interests within it. Mr. Tucker. 4 credits.

756. Regional Economic Analysis
Concepts and methods of delimiting regional economies, theories of regional growth, methods of measuring regional economic activity, empirical approaches to regional economic planning and development, and public policies for regional economies. Primary emphasis will be placed on empirical research studies. Mr. Morris. Prerequisite: intermediate economic theory, elementary statistics, elementary calculus, elementary linear programming, or permission of instructor. 4 credits. (Alternate years; offered in 1973-74.)

795, 796. Investigations in Resource Economics

Soil and Water Science (26)

Hydrology

504. Fresh Water Resources
Background for students desiring to develop a better understanding of freshwater resources. The subject is approached from the viewpoint of the hydrologic cycle and hydrologic budget or water balance. Major topics include precipitation, evaporation, evapotranspiration, infiltration, groundwater, and runoff. Consideration is given to control systems and planning for water resource development. Mr. Byers. 3 lectures; 1 laboratory; 4 credits.

703. Soil and Water Engineering
The treatment of engineering principles relating to the control of water. Major topics include precipitation and stream-flow measurement, hydrograph development, estimating run-off from a watershed, and the design of structures to control this run-off. Laboratory sessions are designed to acquaint the student with instrumentation and problem analysis. Mr. Byers. 3 lectures; 1 laboratory; 4 credits.

705. Principles of Hydrology
The physical and chemical processes involved in the movement of water through the rainfall-runoff segment of the hydrologic cycle. Major topics include infiltration and percolation, overland and channel flow, channel processes, and the nature of the stream discharge record or hydrograph. Laboratory sessions involve the use of a demonstration channel, electrical and fluid models, and
selected problems to demonstrate important principles. Mr. Hall. 3 lectures; 1 laboratory; 4 credits.

710. Ground-Water Hydrology
Introduction to the principles governing the occurrence, location, and development of ground water. Major topics include well hydraulics, geophysical exploration, and chemical quality of water. Brief treatment given of water law and economics. Laboratory sessions are designed to illustrate principles, by use of fluid and electrical models, geophysical instruments, and selected problems. Mr. Hall. Basic course for hydrology majors, but other qualified students welcome. 3 lectures; 1 laboratory; 4 credits.

Soil Science

501. Introductory Soils
Soils as related to the environment in terms of the physical, chemical, and biological aspects. The laboratories are coordinated with the lecture material. Mr. Peterson. 3 lectures; 1 laboratory; 4 credits.

502. Soil-Plant Relationships
Soils in relation to the requirements for optimum growth of plants; methods of determining the amount of nutrient elements in soils available to plants; and recognition of plant symptoms of nutrient deficiency. Transportation fee. Mr. Peterson. Recommended that 502 be taken in conjunction with 501; however, 501 is not a prerequisite. 3 lectures; 1 laboratory; 4 credits.

701. Physics of Soils
The treatment of soil as a physical system. Major topics include: textural and structural analysis of soils, water flow and retention, and heat and gas transfer processes in soils. The influence of soil physical properties on plant growth. Laboratory deals with methods of soil physical analysis. Prerequisite: Soil and Water 501 or permission of instructor. 3 lectures; 1 laboratory; 4 credits.

702. Chemistry of Soils
Chemical properties of soils in relation to their composition and use. Colloidal phenomena and its relation to exchange and fixation of elements in soil. Major topics include: cation exchange, capacity and source of negative charge, the nature of soil acidity, the chemistry of nitrogen and phosphorus in the soil, and modern methods of soil chemical analysis. Laboratory sessions cover analytical methods commonly used in soil chemistry. Mr. Harter. Prerequisite: Chemistry 517 or equivalent, or permission of instructor. 4 lectures; 1 laboratory; 4 credits.

704. Soil Classification and Mapping
The genesis, morphology, classification, and mapping of soils with emphasis on major classification systems used in the United States and throughout the world as they relate to man’s uses of the soil. Transportation fee. Mr. Peterson. Prerequisite: Soil and Water 501 and an introductory geology course, or by permission of instructor. 3 lectures; 1 laboratory; 4 credits.

795, 796. Independent Work in Soil and Water Science
Students with a major in the Department are required to take 795 and 796 for two credits per semester in their senior year. The student may choose his faculty consultant and topic from the options listed below. Students with an interest in some aspect of soil and water science from other departments may also enroll in 795-796 for two credits per course.
1. Soil-Plant Relationships, Mr. Peterson.
2. Physics of Soils.
3. Hydrology, Mr. Byers and Mr. Hall.
4. Chemistry of Water, Mr. Hall.
5. Chemistry of Soils, Mr. Harter.
6. Soil Classification, Mr. Peterson.

Italian
(See French and Italian)

Latin
(See Spanish and Classics)

Liberal Arts (58)
Courses coordinated by the Dean, College of Liberal Arts

400. Understanding and Changing Knowledge and Man
The emphasis will be on understanding the problems and paradoxes in current knowledge and presenting an alternative system which provides the means for changing knowledge and the individual person. Principles developed in class will provide the student with tools for defining problems, asking significant questions, planning, and making decisions so that he can construct a more adequate personal system of knowledge. The integration of knowledge and the development of skills for criticizing knowledge will be stressed. The course will prepare the student to be an active participant in the college community. Prerequisite: permission of instructor. 4 credits. NLG. (Not offered every year.)

695, 696. Independent Study (Honors)
Independent study for the College of Liberal Arts junior or senior honor student whose major department has no independent study course. Prerequisite: junior or senior with honor standing (cumulative average of at least 3.0), approval of student's supervisor, and the department. A junior may register for a total of 8 credits and a senior for a total of 12 credits. (College Dean to be informed of project and instructor.)
Mathematics

Mathematics (51)
Chairman: M. Evans Munroe


VISITING PROFESSOR: Musa Yildiz

ASSOCIATE PROFESSORS: Homer Bechtell, Albert B. Bennett, Jr., William E. Bonnice, David M. Burton, Loren D. Meeker, Eric Nordgren, Robert O. Kimball, Samuel D. Shore

ASSISTANT PROFESSORS: William E. Geeslin, Kenneth L. Lange, Berrien Moore III, Frederick J. Robinson, Albert O. Shar, Donovan Van Osdol

VISITING ASSISTANT PROFESSORS: Charles W. Neville, Mehmet Zeki Orhon

INSTRUCTOR: B. Robert Ellis

403. Introduction to Digital Computer Programming
Development of algorithms and programs. Basic programming and programming structure utilizing the FORTRAN IV language; introduction to the use of an operating system, computer solution of numerical and non-numerical problems. Course is designed for students not intending to pursue further studies in computer science. No credit toward a Mathematics major. 2 credits.

410. Digital Computer Systems
Development of algorithms and programs. Basic programming and program structure utilizing the FORTRAN IV language. Use of programming systems and operating systems. Data representation and the use of number systems in computers. Basic computer organization. Survey of computers, languages, and applications. Computer solution of numerical and non-numerical problems using the IBM 360's operating system. Good for major credit only in interdisciplinary programs. 4 credits.

415. Mathematics of Business and Economics
Topics in analytic geometry, integrals and derivatives, partial derivatives, max-min problems (in one and several dimensions), areas, matrices. Prerequisite: 3 entrance units in college preparatory mathematics. (Registration limited to students in Whittemore School of Business and Economics.) No credit toward a Mathematics major. 4 credits.

420. Fundamental Mathematics
A presentation of basic ideas in several branches of mathematics; sets and functions, calculus, linear algebra, linear programming, abstract algebra. Prerequisite: 3 entrance units in college preparatory mathematics. No credit toward a Mathematics major. 4 credits.

427. Calculus I
First course in analytic geometry and calculus. Instruction is offered at various paces and there is a special testing program so that the student can proceed at his own pace. Prerequisite: at least 3 entrance units of college preparatory mathematics including trigonometry. 4 credits. NLG.

428. Calculus II
Conclusion of introductory course in calculus of functions of one argument. Instruction is offered at various paces and there is a special testing program
so that the student can proceed at his own pace. Prerequisite: Mathematics 427. 4 credits. NLG.

510. Mathematical Computer Problems
Computer programming, including the FORTRAN IV language; introduction to a variety of computer applications in mathematics. Cannot be taken for credit if credit received for Mathematics 410. Prerequisite: Mathematics 527 completed or taken concurrently. 4 credits.

527. Differential Equations with Linear Algebra
An introduction to both subjects which stresses the interplay between them. Linear differential equations, matrix algebra, linear transformations and change of basis, eigenvalues, linear systems, series solution of differential equations. Prerequisite: Mathematics 428. 4 credits.

528. Multidimensional Calculus
Theory, methods, and applications of partial differentiation; composite functions and chain rules; maxima and minima; transformations; vector algebra; vector functions; gradient, divergence, and curl; curves and surfaces; multiple, line, and surface integrals; integral theorems. Prerequisite: Mathematics 428. 4 credits.

531. Introduction to Abstract Mathematics
Fundamental concepts of logic and set theory with applications to the development of the real number system. Prerequisite: Mathematics 428. 4 credits.

621. Arithmetic for Elementary School Teachers
Basic concepts of logic and sets; real numbers and subsystems (properties, history, algorithms, problems of pedagogy); numeration systems; number theory (elementary properties of integers, Euclidean algorithm, divisibility and figurate numbers.) Prerequisite: consent of instructor. No credit toward a Mathematics major. 4 credits.

622. Algebra for Elementary School Teachers
Functions (relations, operations, graphs, polynomials and their roots, and systems of equations); finite systems (modular arithmetic, linear congruence, and symmetries); groups, rings, and fields (elementary concepts with applications to numbers systems and factoring.) Prerequisite: Mathematics 621. No credit toward a Mathematics major. 4 credits.

623. Geometry for Elementary School Teachers
Euclidean geometry (construction and basic concepts of plane and solid geometry); analytic geometry (basic concepts, applications to geometry), congruences and similarity, vectors (operations and applications). Prerequisite: Mathematics 621. No credit toward a Mathematics major. 4 credits.

636. Probability and Statistics
Sample spaces (discrete only), events, combinations, conditional probability, independence, distributions, expectation, statistical description, random variables, sampling, estimation, tests, and applications of statistics in research. Good for major credit in Mathematics-Education only. 4 credits.

645-646. Analysis for Applications
Applied matrix theory; eigenvalue problems and their applications in mathematics, physics, and engineering; systems of linear ordinary differential equations; initial-boundary-value problems of mathematical physics; Sturm-Liouville problems; series expansions by orthogonal functions; Green's functions; numerical methods. Prerequisites: Mathematics 527-528. 4 credits.
Mathematics

647. Complex Analysis for Applications
Complex numbers; complex integration; infinite series; contour integration; conformal mapping; Fourier and Laplace transforms; Wiener-Hopf techniques. Prerequisite: Mathematics 528. 4 credits.

656. Introduction to Number Theory
Unique factorization, linear and quadratic congruences, quadratic reciprocity law, arithmetic functions, quadratic forms, an introduction to algebraic numbers. Prerequisite: Mathematics 531. 4 credits. (Alternate years; offered in 1974-75.)

657. Geometry I
Fundamental properties of Euclidean geometry from an advanced standpoint. Prerequisite: Mathematics 531. 4 credits.

658. Geometry II
Systems of postulates of various geometries, geometric invariants, synthetic and analytic projective geometry, introduction to non-Euclidean geometry. Prerequisite: Mathematics 531. 4 credits. (Alternate years; offered in 1973-74.)

682. Nonlinear Differential Equations
Phase plane analysis of linear and nonlinear autonomous systems; critical points; limit cycles; periodic solutions; approximate methods for second order nonlinear ordinary differential equations; stability and asymptotic behavior of solutions of linear and nonlinear equations. Prerequisite: Mathematics 527. 4 credits. (Alternate years; offered in 1973-74.)

696. Independent Study
Individual study projects in various areas of mathematics as determined to be of interest and value to the student and the department. Supervision is by an appropriate faculty member. Consent of the faculty supervisor and department chairman is required. 1-6 credits.

698. Senior Seminar
Individual study on special topics. Preparation and presentation of reports on topics assigned. Prerequisite: senior standing in mathematics. (Offered only in Mathematics-Education.) 4 credits.

710. Advanced Programming Systems
This course will cover topics in systems programming, including the use and implementation of assemblers, loaders, macros, compilers, and operating systems. Machine language, assembler language, subroutine linkage, debugging, conditional assembly, job control language, I/O programming. Memory, processor, device, and information management. Structure of compilers and other system components. Selected problems will be programmed and run on a computer in the Computation Center. Prerequisite: Mathematics 410 or 510. 4 credits.

711. Programming Languages and Compiler Construction
Introduction to recursive processes; a sketch of PL/I and ALGOL. Formal syntax and Backus-Naur form, syntax directed compilers, semantic routines, symbol table structures, resource allocation, parsing algorithm, code generation, and optimization of translator writing systems. Associated computer laboratory work. Prerequisite: Mathematics 710. 4 credits.

735. Probability
Sample spaces (discrete and continuous); random variables; conditional probability; moments; binomial, Poisson, and normal distributions; limit theorems for sums of random variables. Prerequisite: Mathematics 528. 4 credits.
736. Statistics
Sampling theory, estimation of parameters, testing of hypotheses, non-parametric methods. Prerequisite: Mathematics 735. 4 credits.

753, 754. Numerical Methods and Computers
This course is oriented toward the use of numerical analysis on digital computers (with laboratory). Computer organization, algorithmic languages, and compilers, solution of polynomial and transcendental equations, numerical solutions of differential equations, linear systems of equations, eigenvalues and eigenvectors, polynomial interpolation, quadrature, curve fitting, discussion of errors, systems simulations, and mathematical optimization techniques. Selected algorithms will be programmed for solution on high-speed computers in the Computation Center. Prerequisites for 753: Mathematics 410 or 510 and 428. Prerequisites for 754: Mathematics 410 or 510 and 527. 4 credits.

761. Abstract Algebra
A study of the basic properties of groups, rings, fields, and their homomorphisms. Prerequisite: Mathematics 531. 4 credits.

762. Linear Algebra
Vector spaces, linear transformations, matrices, determinants, dual spaces, eigenvalues, spectral and canonical decomposition theorems. Cannot be taken for credit if credit received for Mathematics 645. Prerequisite: Mathematics 761. 4 credits.

764. Advanced Algebra
Vector spaces, modules over principal ideal domains, structure of finitely-generated modules, finite abelian groups, elementary theory of fields. Prerequisite: Mathematics 761. 4 credits. (Alternate years; offered in 1974-75.)

767. One-dimensional Real Analysis
Theory of limits, continuity, differentiability, integrability, series, uniform convergence. Prerequisites: Mathematics 528, 531. 4 credits.

768. Abstract Analysis
Metric spaces, function spaces, theory of uniform limits. Prerequisite: Mathematics 767. 4 credits. (Alternate years; offered in 1973-74.)

769. Multidimensional Real Analysis
Partial derivatives, multiple integrals, line and surface integrals, Fourier series. Prerequisite: Mathematics 767. 4 credits. (Alternate years; offered in 1974-75.)

776. Logic
Development of formal mathematics. Discussion within that system of formal systems. Consistency, completeness, decidability. Prerequisite: Mathematics 531. 4 credits. (Alternate years; offered in 1973-74.)

780. Theory of Ordinary Differential Equations
Fundamental existence and uniqueness theorems; linear systems and higher order linear equations; Wronskian theory; classical Sturm Theorem and generalizations; boundary value problems for second order linear equations. Prerequisite: Mathematics 767. 4 credits. (Alternate years; offered in 1974-75.)

781. Partial Differential Equations
First order equations; linear second order equations; Cauchy problem; Dirichlet problem; application to physics. Prerequisite: Mathematics 767. 4 credits. (Alternate years; offered in 1973-74.)
784. Topology
Basic topological notions, connectedness, compactness, metrizability, with special emphasis on the real line and plane. Prerequisite: Mathematics 531. 4 credits.

785. Algebraic Methods in Topology
Topics to be selected from: topology of manifolds, topological groups, homology, knot theory. Prerequisite: Mathematics 784. 4 credits. (Alternate years; offered in 1973-74.)

786. Calculus on Manifolds
Differentiable manifolds; differential forms; exterior and Grassman algebras; integration of differential forms; Stokes theorem; closed and exact differential forms. Cannot be taken for credit if credit is received for Mathematics 769. Prerequisites: Mathematics 762 and 767. 4 credits. (Alternate years; offered in 1974-75.)

787. Differential Geometry
Introduction to Lie groups and frame bundles; differential invariants of surfaces and curves; local theory of surfaces. Prerequisite: Mathematics 786. 4 credits. (Alternate years; offered in 1974-75.)

788. Complex Analysis
Complex functions, sequences, limits, differentiability and Cauchy-Riemann equations, elementary functions, Cauchy's theorem and formula, Taylor's and Laurent's series, residues, conformal mapping. Cannot be taken for credit if credit is received for Mathematics 647. Prerequisite: Mathematics 767. 4 credits.

791. Mathematics-Education
A study of secondary school mathematics curriculum problems and the recommendations of various study groups concerning secondary school mathematics. Prerequisites: Education 481 and 657. 4 credits.

Mechanical Engineering (52)
Chairman: William Mosberg

ASSOCIATE PROFESSORS: E. Eugene Allmendinger, Wayne M. Beasley, Frederick G. Hochgraf, Tenho S. Kauppinen, William Mosberg, Russell L. Valentine
VISITING ASSISTANT PROFESSORS: Barbaros Celikkol, Allen H. Magnuson

341. Introduction to Manufacturing
A course to orient students so that they can safely operate basic machine tools on design projects or in a home workshop. Two 2 1/2-hour sessions per week for 6 weeks (offered twice each semester). 0 credit.

413. Engineering Graphics
Communication of engineering information and concepts by multiview drawings, pictorial views, sketches, and graphs. 1 laboratory; 2 credits.
414. Engineering Graphics
The analysis of various engineering problems employing the fundamentals of descriptive geometry. Prerequisite: Mechanical Engineering 413. 1 laboratory; 2 credits.

441. (441). Engineering Graphics
Communication of engineering information and three-dimensional concepts by multiview drawings, pictorial views, sketches, and graphs; including the fundamentals of descriptive geometry. 2 laboratories; 4 credits.

501-502. Dynamic Linear Systems I and II
Dynamics of electrical and mechanical linear systems, mathematical modeling, linear system transient and steady-state analysis, Laplace transforms, Fourier series, frequency response and power. Prerequisite: Mathematics 428 and Physics 408. 2 lectures; 2 recitations; 4 credits.

503. (503). Thermodynamics I
The fundamental laws of thermodynamics and their relation to working substances. Prerequisite: Mathematics 426. 4 credits.

504. Thermodynamics II
A comprehensive study of the laws of thermodynamics and their application to real systems, presented as lectures and experimental studies; behavior of ideal and real media; thermodynamics of non-reactive and reactive mixtures. Prerequisite: Mechanical Engineering 503. 4 credits.

508. Fluid Dynamics
Introduction to the dynamics and thermodynamics of compressible and incompressible fluid flow; analysis of the behavior of fluids as expressed by hydrostatic, continuity, momentum, and energy equations. Prerequisites: Mechanical Engineering 503 and 524. 4 credits.

515-516. Systems Laboratory I and II
Introductory experiments with electrical, mechanical, and electromechanical systems. To be taken concurrently with Mechanical Engineering 501, 502. 1 credit.

523-524. Mechanics I and II
The static and dynamic behavior of rigid and deformable bodies. Equilibrium, compatibility, and force-deformation relations; stress, strain, and constitutive relations; elastic stability; energy methods; stress and deformation in materials and simple structural elements. Review of particle dynamics; kinematics and kinetics of rigid bodies in two and three dimensions. Prerequisites: Mathematics 427, Physics 407. 4 credits.

541. Manufacturing Processes and Design
Manufacturing drawings, sketching basic mechanisms found in machine shops, operation of basic machine tools. 1/2-hour lecture before 2-hour laboratory (2 times per week); 4 credits.

542. Methods in Manufacturing
A project course for students who wish to obtain more experience on machine tools. Prerequisite: Mechanical Engineering 341 or 541. Two 2 1/2-hour laboratories per week; 2 credits.

561. Introduction to Materials Science
Theoretical and experimental studies of the structure and thermodynamics of solids. 3 lectures; 1 laboratory; 4 credits.
562. Introduction to Materials Engineering  
Critical aspects of the physics and chemistry of selected processes in materials technology. Phase transformations in ceramics, phase transformations in ferrous alloys, sintering, solidification, semiconductor device fabrication. Extended lab hours for plant visits. 3 hours; 1 laboratory; 4 credits.

643-644. Elements of Design I and II  
Synthesis, analysis, and design of machine components. Development of engineering judgment; selection of materials; kinematic arrangements; design factors; failure criteria; fluctuating loads; design for finite and infinite life; stress concentration; statistical methods. Prerequisites: Mechanical Engineering 523 and 524. 2 1-hour periods; 1 2-hour period; 4 credits.

646. Deterministic and Stochastic Measurement  
The dynamic analysis of instrumentation systems, the resulting dynamic measurement errors, measurement system synthesis for specified dynamic accuracy and methods of correcting data which has dynamic errors. Introduction to the description of stochastic processes. Fourier transforms, power spectral density and autocorrelation functions and their application to measurements on systems with random excitation. 4 credits.

691. Economic Decision Making in Engineering  
The principles that form the basis for making engineering decisions to obtain the most favorable economic results. Prerequisite: senior standing. 4 credits.

695 a-d—696 a-d. Mechanical Engineering Undergraduate Projects and Independent Study  
Course numbers refer to topics in a) thermal science, b) solid mechanics, c) engineering design, and d) materials, respectively. 2-4 credits.

697-698. Mechanical Engineering Seminar  
2-4 credits.

699. Undergraduate Thesis  
2-4 credits.

701. Macroscopic Thermodynamics  
A continuation of the study of thermodynamic principles using an analytical approach consistent with that of Gibbs and Caratheodory. Prerequisite: Mechanical Engineering 503. 4 credits.

702. Statistical Thermodynamics  
An introduction to statistical thermodynamics. Prerequisite: Mechanical Engineering 503. 4 credits.

703. Heat Transfer  
Analysis of heat transfer phenomena; steady-state and transient conduction, radiation, and convection; engineering applications. Prerequisite: Mechanical Engineering 508 or taken concurrently. 4 credits.

704. Experimental Heat Transfer  
Experimental methods in the study and solution of heat transfer problems, including a critical comparison with analytical and other methods. Literature surveys and written and oral presentation of results will be emphasized. Prerequisite: Mechanical Engineering 703. 4 credits.
707. Analytical Fluid Dynamics
   An analytical study of the dynamic behavior of fluids. Topics include potential
   flow, development of the Navier-Stokes equations, turbulence, and boundary-
   layer theory. Prerequisite: Mechanical Engineering 508. 4 credits.

708. Gas Dynamics
   Basic equations of motion of one-dimensional, subsonic and supersonic flows
   of compressible, ideal fluids. Wave phenomena. Rankine-Hugoniot relations.
   Linear approach to two-dimensional flow problems. Prerequisite: Mechanical
   Engineering 508. 4 credits.

715. Internal Combustion Engines
   Application of basic and engineering science to the engineering problems of
   spark and compression ignition engines, design, management, and reporting of
   experimental studies. Prerequisite: Mechanical Engineering 503. 4 credits.

716. Propulsion Systems
   Application of basic engineering sciences to the engineering problems of pro-
   pulsion systems. Prerequisite: Mechanical Engineering 508. 4 credits.

717. Cryogenics
   The phenomena and processes associated with very low temperatures. Appli-
   cation of basic engineering sciences to the problems of low temperature re-
   frigeration, liquefaction, separation, and storage; transport of cryogenic fluids;
   measurement systems; vacuum technology. Prerequisite: Mechanical Engineering
   503. 4 credits.

723. Advanced Dynamics
   A traditional course in classical mechanics with an orientation to contemporary
   engineering applications. Review of particle dynamics. Hamilton’s principle and
   the Lagrange equations. Kinematics and dynamics of rigid bodies, gyroscopic
   effects in machinery and space structures. 4 credits.

724. Introduction to Vibrations
   The theory of discrete vibrating systems is treated in depth. Review of linear
   system concepts and detailed treatment of the single-degree-of-freedom system
   with general excitation. Matrix theory and eigenvalue problems. Many degrees
   of freedom, normal mode theory for free and forced vibration. Numerical
   methods. Introduction to continuous systems. Applications are made both to
   structural and mechanical systems. 4 credits.

726. Experimental Mechanics
   Experimental methods and their underlying theoretical bases are developed
   and applied to the measurement of stress, strain, and motion. Topics covered
   include transmitted and scattered-light photoelasticity, strain gage applications,
   brittle coating and grid techniques, dynamic measurements and associated in-
   strumentation. 4 credits.

727. Advanced Mechanics of Solids
   Advanced topics in the mechanics of solids are treated in depth; beams on
   elastic foundation, curved bars, inelastic behavior, instability, introduction to
   thin plates and shells, introduction to elasticity, energy methods, and numerical
   methods. 4 credits.

730. Mechanical Behavior of Materials
   The elastic and inelastic behavior of materials, both organic and inorganic, is
   studied from the micromechanics and macromechanics points of view. Concepts
   of stress, strain, and constitutive relations are reviewed and related to recent

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developments in dislocation theory and other phenomena on the atomic scale and to continuum mechanics on the macroscopic scale. Mechanical behavior including elasticity, plasticity, viscoelasticity, creep, fracture, and damping will be treated. Anisotropic and heterogeneous materials such as composite materials will be studied in detail. 4 credits.

737. Ocean Mechanics I
Ocean as a continuous medium, its mechanical and thermodynamic properties are presented. Shallow and deep ocean modeling for the investigation of gravity waves and sound waves along with the varying mechanical and thermodynamic properties are discussed. Ocean subbottom and its soil mechanical as well as sound propagation properties are introduced. Ocean instrumentation and rudimentary data collecting and processing procedures are given and computer usage is emphasized. Prerequisites: Mechanical Engineering 523, 524; Mechanical Engineering 508; Mathematics 527, 528. 4 credits.

738. Ocean Mechanics II
Ocean dynamical laws are generalized to include temperature and salinity variations in the water column. Conservation laws with generalized equation of state are developed. Air-sea interaction, and energy transport phenomena, reflection from different coastal geometry, harbour resonances, internal currents. Sound reflection from subbottom, sound probing techniques to determine subbottom properties by ray theory and generalization of subbottom soil from an elastic to a viscoelastic medium. Prerequisite: Mechanical Engineering 737. Mechanical Engineering 781 is desirable but not required. 4 credits.

741. Control of Physical Systems
The mathematical modeling of hydraulic, pneumatic, and fluidic control elements and control systems. Methods are developed for the analysis of systems using gases or liquids as the working fluid. Methods for the synthesis of the parameters of the control elements used in automatic control systems are developed and methods of design of these systems are discussed. 4 credits.

751. Naval Architecture in Ocean Engineering
Naval architectural principles related to surface and submerged vehicles are developed—including hydrostatic characteristics, fundamentals of powering, and rules and regulations of importance to this aspect of ocean engineering. Prerequisites: Mechanical Engineering 508 or permission of instructor. 4 credits.

752. Submersible Vehicle Systems Design
A lecture and design course. Lectures review material pertinent to design including a historical perspective, environmental factors, hydromechanic and structural principles, materials, intra-vehicle systems, extra-vehicle systems, operating considerations, pre-design and design procedures. Conceptual and basic preliminary designs of selected submersible vehicles are prepared by student teams. 4 credits.

757. Coastal Engineering and Processes
Fundamentals of water waves and their effects. Development of governing equations for surface waves and laboratory tank demonstration of wave trains, heat waves, and wave spectra. Estuarial and coastal processes including wave refraction and long shore transport of sediments simulated by computer models. Effects of structures on waves and functional design of structures including towers, breakwaters, and ocean outfall. 4 credits.
761. X-Ray Diffraction
The physics of x-ray diffraction, the reciprocal lattice, lattice parameter determinations, space group identification, phase identification, characterization of preferred orientation. 3 lectures; 1 laboratory; 4 credits.

763. Microstructure of Solids
Basic concepts and measurements of microstructures; statistically exact expressions for points, lines, surfaces, and volumes; random, partially oriented and oriented structures; particle and grain characteristics and distributions; projected images and shape specification. 4 credits.

Mathematical methods in engineering sciences are discussed, including methods for solution of discrete and continuous systems. Course includes a review of calculus, linear algebra, complex numbers, Fourier series, differential and partial differential equations with examples from acoustics, vibration theory, hydrodynamics, elasticity, solid mechanics, transport theory, and particle mechanics. 4 credits.

793 a-d—794 a-d. Special Topics in Engineering
Course numbers refer to topics in a) thermodynamics, b) mechanics, c) engineering design, and d) materials, respectively. Content of these courses may vary from year to year. 24 credits.

795 a-d—796 a-d. Independent Study
Course numbers refer to topics in a) thermal science, b) solid mechanics, c) engineering design, and d) materials, respectively. 24 credits.

Medical Technology (37)
Supervisor of the Program: Gary S. Moore

ASSISTANT PROFESSOR: Gary S. Moore
LECTURER: John C. Neff

School of Medical Technology, Hanover, N.H.
ADJUNCT ASSISTANT PROFESSOR: E. Elizabeth French
CLINICAL INSTRUCTOR: Elizabeth A. Ward
LECTURERS: Nancy C. Bigelow, Diane V. Bowen, Miriam K. Fogg, Gertrude M. Marguay, Jane E. Perkins

(401). Introduction to Medical Technology
Presentation of information about the profession of medical technology, the various phases of laboratory medicine involved, its functions and responsibilities as a unit of the health team. Taught by lectures, films, demonstrations, and field trips. For second semester freshman and sophomore majors in medical technology. Mr. Moore and Mr. Neff. 0 credits.

710. Medical Mycology
The morphological, cultural, biochemical, serological, and pathogenic characteristics of fungi that cause human and animal diseases. Mr. Moore and Mr. Neff. Prerequisite: permission of instructor. 2 lectures; 1 laboratory; 4 credits.
Microbiology

761-762. Clinical Laboratory Methods
An 11-month course in medical technology taken at the Mary Hitchcock Memorial Hospital School of Medical Technology, Hanover, New Hampshire. This course starts about July 6, and includes lectures and laboratory work in bacteriology, blood bank and serology, clinical chemistry, hematology, laboratory management and ethics, mycology, parasitology, histology, and clinical microscopy. Credits will be allowed when the University has received a transcript of the candidate's record and upon certification by the Director of the School and the Supervisor of the Medical Technology curriculum that the work has been successfully completed. This course qualifies a candidate for the examination for the Medical Technology's Certificate administered by the Registry of Medical Technologists of the American Society of Clinical Pathologists. 32 credits. This course cannot be taken for graduate credit.

Microbiology (70)
Chairman: Theodore G. Metcalf

Professors: William R. Chesbro, Galen E. Jones, Theodore G. Metcalf, Lawrence W. Slanetz
Assistant Professors: Thomas Pistole, Robert M. Zsigray

501. Public Health and Sanitation
The nature and types of microbes which cause infectious diseases; the prevalence, transmission, and control of these diseases. Sanitation of water, sewage, food, and air. Community hygiene and public health administration. Prerequisite: Biology 401, 402 or permission of instructor. 4 credits.

503. General Microbiology
Principles of microbiology; morphology, physiology, genetics, and classification of bacteria and other microorganisms, and their relationships to agriculture, industry, sanitation, and infectious diseases. Prerequisite: Chemistry 401-402 or equivalent. 2 lectures; 2 laboratories; 4 credits.

600. Environmental Microbiology
The roles of microorganisms as agents which may enhance or deteriorate the quality of the environment from the human standpoint; the detection, identification, and regulation of microorganisms important in pollution control in water, in contamination and spoilage of foods and other items of utility, in the quality of air, and in the production of foods and other products; the role of law, legal standards, and/or governmental agencies in promoting and maintaining the microbiological quality of the environment. Prerequisite: Microbiology 503. 2 lectures; 2 laboratories; 4 credits.

701. Advanced Microbiology
The growth, nutrition, and metabolism of microorganisms; consideration of cell structure and localization of function; aspects of genetic and non-genetic regulation of metabolism; study of the influence of chemical and physical factors of the environment upon microorganisms. Prerequisite: Microbiology 503. 2 lectures; 1 laboratory; 4 credits.
702. Pathogenic Microbiology
The morphological, cultural, biochemical, serological, and pathogenic characteristics of microorganisms causing human and animal diseases. Prerequisite: Microbiology 503. 2 lectures; 2 laboratories; 4 credits.

705. Immunology and Serology
The defensive elements possessed by men and animals which serve to protect them from infectious microorganisms. The principles of serological techniques used in the recognition and identification of biological materials including microorganisms. The preparation of vaccines and the production of antisera in animals. Prerequisite: Microbiology 702. 2 lectures; 2 laboratories; 4 credits.

706. Virology
The animal and plant viruses, including bacteriophages and the rickettsiae; a consideration of techniques for the propagation and recognition of animal viruses; a study of the interactions between virus and host cell and the application to problems of plant or animal infections caused by viruses. Prerequisite: Microbiology 702. 1 lecture; 3 laboratories; 4 credits.

707. Marine Microbiology
Characterization of microbes in the sea as to taxonomy, physiology, ecology, and transformation of carbon, nitrogen, sulfur, and phosphorous; methods of sampling and enumeration; biogeochemistry; properties of sea water and the marine environment. Parallels to soil microbiology will be drawn. Prerequisite: Microbiology 503 and biochemistry. 2 lectures; 1 laboratory; 4 credits.

795, 796. Problems in Microbiology
Special problems, depending upon the training and desire of the student. Prerequisite: permission of department chairman and staff concerned. 4 credits.

Music
Chairman: Keith Polk

PROFESSORS: Karl Bratton, emeritus; Donald E. Steele, John D. Wicks
ASSOCIATE PROFESSORS: Irving D. Bartley, emeritus; Alan Grishman, Keith Polk, Mary Rasmussen, John Rogers, John Whitlock
ASSISTANT PROFESSORS: Mark DeVoto, Ruth Edwards, Stanley Hettinger, Cleveland Howard, David Seiler, Niel Sir, Paul Verrette, Henry Wing, Jr.
VISITING ASSISTANT PROFESSOR: Ada-Louise Rogers
LECTURERS: Donald Bravo, Lynda Copeland, Norman Dee, Robert DeVries, Madeline Foley, Meredyth Jones, William Nicol, Natalo Paella, John Skelton, Louise Wear

History, Literature and Appreciation (71)

401. Introduction to Music
A fundamental approach to perceptive listening, based on a detailed study of several masterpieces representing different periods and forms. Historical perspective is utilized in cultivating the skill of listening, but the main emphasis is on confronting significant works of musical art on their own terms. Some participation in the musical life of the University community is also required. Not open to music majors. 4 credits.
Music

402. Survey of Music History
A survey of the historical development of musical style in relation to the whole fabric of Western civilization. Prerequisite: Music 401. Not open to music majors. 4 credits.

501, 502. History and Literature of Music
An introduction to the styles, forms, and techniques of composition in Western music. Required of all music majors. 4 credits.

511. Survey of Music in America
The development of music in the United States from Colonial times to the present, including the various European influences, the quest for an American style, and the emergence of such indigenous phenomena as jazz. Prerequisite: Music 401 or 501. 4 credits.

513. Introduction to the Music of Africa and Asia
A survey of the folk and classical music of various ethnic cultures, particularly those of Japan, India, and sub-Saharan Africa. Prerequisite: Music 401, 501, or permission of instructor. 4 credits.

595. Special Topics in Music Literature
This course allows both music majors and non-majors to explore any of a variety of topics mutually agreed upon by students and instructor. The subjects will be in areas not easily covered in courses operating in the usual historical framework. Conferences and papers as required by the instructor in charge. May be repeated for credit. 1-4 credits.

695. Honors Program, Independent Undergraduate Study
An honors program involving two types of work: (1) The student pursues independent study in one or more specialized areas. (2) The student attends a seminar concerned with an area in which no appropriate course is offered in the undergraduate curriculum. The student will be given an opportunity in the seminars to discuss his own research with members of the faculty and other participating students. Prerequisite: an average of 3.0, or exceptional aptitude for music and permission of instructor. 2 or 4 credits.

701. Music of the Medieval Period
The nature of the beginnings of polyphony. The pre-eminent influence of the church in the thirteenth century and the rising secular movement in the fourteenth. Music as a dominant force in the political and social life of the Middle Ages. 4 credits.

703. Music of the Renaissance
A study of the works of the composers of the fifteenth and sixteenth centuries from Dunstable to Palestrina. 4 credits.

705. Music of the Baroque
A study of the music of Europe from de Rore to Bach. 4 credits.

707. Music of the Classical Period
The growth of musical styles and forms from early classical, Baroque-influenced composers through the high classicism of Haydn and Mozart, to the budding romanticism of the young Beethoven. The class will hear representative works in the areas of symphony, concerto, and opera. 4 credits.

709. Music of the Romantic Period
The symphonies, concerti, chamber music, and keyboard works of Beethoven, Berlioz, Schubert, Mendelssohn, Schumann, Brahms, Franck, Chopin, and Liszt.
Romantic elements contained in the development of harmony, orchestration, sonority, expressive content. The rise of the short piano piece, the German art song, the symphonic poem, nationalism in music. 4 credits.

711. Music of the Twentieth Century
A study of contemporary music including its literature, its trends, and an analysis of techniques, styles, forms, and expression. 4 credits.

721. The Life and Works of Beethoven
The piano sonatas, the concerti, symphonies, and string quartets. Lectures, analysis, reports, required readings, and listening. 4 credits.

732. The Art Song
A study of the history and literature of the solo song with piano accompaniment. The course is intended to provide a broad background in the various national styles of the nineteenth and twentieth centuries as well as deeper study of the central core of the art song—the German lied. 4 credits.

733. Survey of Opera
An investigation of representative masterpieces of this art form through listening, reading, and discussion. 4 credits.

735-736. Survey of Pianoforte Literature
The history and development of keyboard literature from Bach to the present. Discussion and performance of the works of Bach; the sonatas and concerti of Haydn, Mozart, Beethoven, Schubert, the Romantic composers, and of contemporary writers. 4 credits.

795. Special Studies in Music Literature
Presuming a sound musical background, this course allows the student to investigate independently and in depth any of a vast range of subjects. Barring duplication of material, this course may be repeated for credit. Prerequisite: permission of instructor. 1-4 credits.

Performance (71)
Registration for musical organization courses should be completed during the registration period. All music laboratory courses may be repeated. A maximum of 8 credits earned in music laboratory may be used toward graduation.

Private lessons are based on half-hour individual instruction per week. One semester hour credit may be earned with one lesson per week: two or four semester hours of credit may be earned with two lessons per week (only students in the Bachelor of Music curriculum are allowed to register for four credits). Five one-hour practice periods are expected for each credit of private study. The special semester fee for lessons is $35 per half-hour lessons (this fee applies for courses numbered 541 through 550). The fee includes the use of a practice room for the required preparation.

Registration in courses of private instruction is open to all students in the University, subject to approval by the Music Department and instructor. Enrollment is limited in these courses. A student may register for credit in successive semesters.

441, (441). Concert Choir—Techniques and Literature
A choral group devoted to study and performance of the best classical and modern choral literature. Recommended for men and women voice majors. Open to all interested students. Prerequisite: permission of instructor. 2 laboratories; 1 credit.
Music

442, (442). Chamber Chorus
A mixed chorus which studies and performs sacred and secular works from the Renaissance to the present. The chorus participates from time to time with the opera workshop and with the orchestra, and serves as a nucleus for larger choral-instrumental works. Prerequisite: permission of instructor. 2 laboratories; 1 credit.

444, (444). The New Hampshiremen
The male chorus of the University. Open to all students interested in singing the finest of literature in this medium and who fulfill the requirements of a tryout. Recommended for all men voice majors. Prerequisite: permission of instructor. 2 laboratories; 1 credit. NLG.

445. Summer Session Chorus and Basic Conducting
A choral group devoted to the study and performance of the best classical and modern choral literature. The basic elements of choral conducting for elementary and secondary teachers, church choir directors, and those interested in singing. 1 credit. (Special Summer Session course which may be repeated.)

448, (448). Opera Workshop
Experience in operatic singing, acting, and production techniques is offered through performance of both complete operas and operatic excerpts. Prerequisite: permission of instructor. 1 credit.

450, (450). University of New Hampshire Symphony—Techniques and Literature
The orchestra, open to all students on the basis of individual auditions, presents several concerts during the year of repertoire ranging from the great standard symphonic literature to experimental multimedia composition. Prerequisite: permission of conductor. 2 laboratories; 1 credit.

451, (451). University of New Hampshire Training Orchestra
The training orchestra is designed for music education majors but is open to all who wish to develop instrumental proficiency on their major or secondary instruments. The course provides ensemble experience in the basic repertoire often met in school situations for students who do not yet meet the standards required for participation in the UNH Symphony. 1 laboratory; 1 credit.

452. University of New Hampshire Symphonic Wind Ensemble
The Wind Ensemble studies and performs the finest in wind instrument literature and is open to all students on the basis of audition. Performances include campus concerts and tour appearances throughout New England. Prerequisite: permission of instructor. 4 laboratories; 1 credit.

453. University Band
The University Band repertoire is chosen from the standard band literature and includes original band music, transcriptions, marches, etc. The University Band functions as a musical outlet for those students whose schedule or interest does not permit music as a major interest, but are interested in maintaining their playing proficiency and continuing their study of music. Prerequisite: permission of instructor. 2 laboratories; 1 credit.

454. University of New Hampshire Marching Band
The Marching Band is open to all students and performs during the football season at home and away games. Rehearsals of the Marching Band conclude at the end of the football season. Prerequisite: permission of instructor. Students planning to remain in the band program at the conclusion of the football season should register for Music 452 or 453. 4 laboratories; 0 credit.
455. (455). Piano Ensemble—Techniques and Literature
A laboratory course in ensemble playing and accompaniment. Drawing from available student instrumentalists and singers, the pianist learns the art of performing in trios, duo sonatas, two-piano works, and gains experience in Lieder accompaniment. 1 credit.

456. (456). String Ensemble—Techniques and Literature
457. (457). Woodwind Ensemble—Techniques and Literature
458. (458). Brass Ensemble—Techniques and Literature
In these three courses small groups of performers are organized in order that more advanced students may gain experience in chamber music performance and literature. Prerequisite: permission of instructor. 1 credit.

467. (467). Functional Piano
Basic instruction for music majors with no previous keyboard training. The subject matter is drawn from the following: pianoforte technique, keyboard harmony geared to the practical harmonization of simple melodies, sightreading, transposition, and modulation. The format may involve both class instruction and periodic short individual lessons depending upon the increasing facility of the student. The course may be repeated until the Music Education proficiency level is attained to a maximum of 4 credits. Prerequisite: permission of instructor. 1 credit.

541, (541). Voice
Instruction in voice will seek to develop those qualities which are essential for intelligent interpretation, such as correct posture, breathing, pure tone, resonance, clear enunciation, and technical facility. Each voice is given the treatment best suited to its individual needs. A higher ideal than the perfection of mere mechanical skill is sought, namely a musical style of singing and a thorough appreciation of the best works of the masters, both classic and modern. Prerequisite: permission of instructor. 1 or 2 lessons; 1, 2, or 4 credits.

542, (542). Piano
The methods of presentation and the material used vary with each pupil and his degree of advancement. Emphasis is placed on musical values, musicianship, and sound piano technique. For this purpose, the literature employed is selected from the masters. Musical understanding is developed and quality of performance is stressed. With the attainment of advanced technique, the student's repertory is broadened to include works of all periods of literature. Prerequisite: permission of instructor. 1 or 2 lessons; 1, 2, or 4 credits.

543, (543). Harpsichord
Instruction on the Adams harpsichord, the lessons covering harpsichord technique and early keyboard repertoire, with emphasis on keyboard practices of the eighteenth century. 1 or 2 lessons; 1, 2, or 4 credits.

544, (544). Organ
Thorough training in the fundamentals of manual and pedal technique primarily through a graded approach to baroque and modern organ compositions. Advanced students will also receive training in service playing, improvisation, and figured bass realization. Prerequisite: permission of instructor. 1, 2, or 4 credits.

545, (545). Violin, Viola
Students receive a thorough technical foundation on the violin or viola with emphasis on musicianship and musical values. The choice of literature, drawn from the great instrumental repertoire, will depend on the individual student's background and ability. Prior experience is a prerequisite. Permission of instructor. 1 or 2 lessons; 1, 2, or 4 credits.
Music

546. (546). Violoncello; String Bass
Objectives are based primarily on the student’s ability and experience. A general awareness of the instrument as regards technique and tone are the first essential prerequisites. These elements will gradually broaden to include the attention and cultivation of the student’s musical perception and repertoire. Prerequisite: permission of instructor. 1 or 2 lessons; 1, 2, or 4 credits.

547. (547). Woodwind
Instruction in the technique and literature for the flute, oboe, clarinet, bassoon, and saxophone. Ability and previous background determines a student’s course of study. Competence in basic fundamentals of tone production, embouchure, articulation, and phrasing lead to concentration in the solo and chamber music repertoire for each instrument. The development of sound musicianship through study of music representative of all periods and styles is stressed. At least one public solo performance each semester is required. 1 or 2 lessons; 1, 2, or 4 credits.

548. (548). Brass
Instruction in any of the following instruments: trumpet, trombone, French horn, baritone, and tuba. Correct tone production, articulation, and musical interpretation are stressed. Prerequisite: permission of instructor. 1 or 2 lessons; 1, 2, or 4 credits.

549. (549). Percussion
Snare drum rudiments. The technique, tuning, and sticking of the timpani. Cymbals and all other percussion effects (claves, maracas, triangle, tambourine, wood-block, chimes, etc.), glockenspiel, bells, or bell lyre as well as xylophone. Prerequisite: permission of instructor. 1, 2, or 4 credits.

550. (550). Harp
Instruction includes exercises for the development of technique and emphasizes the literature for the harp both in solo and ensemble work. This course is offered by special arrangement only with the Chairman of the Music Department. 1 or 2 lessons; 1, 2, or 4 credits.

551-552. Conducting Methods
The development of conducting—physical aspects, equipment of conductor, fundamental gestures and beats, baton techniques. The reading and analysis of full and condensed scores, study of transposition, psychology of rehearsal. Prerequisite: Music 571-572 and junior standing. 2 credits.

An investigation of music for vocal, vocal-instrumental, and instrumental ensemble, circa 1100 to 1450, and its realization in performance, especially with regard to rhythm, musica ficta, notation, melodic ornamentation, improvised polyphony, and the clear projection of a polyphonic texture. Course work includes an evaluation of the writings of selected Medieval theorists and modern scholars; practical exercises in transcription; and performance on reconstructions of Medieval instruments, especially the organ, harp, psaltery, rebec, vielle, and recorder. 2 or 4 credits.

756. (756). Performance Studies in Renaissance Music
An approach to the problems of musical performance, circa 1450 to 1600, via the small vocal, vocal-instrumental, and instrumental ensemble, with special reference to rhythm and tempo, musica ficta, text underlay, articulation, diminution, tablature notation, and effective distribution of voices and instruments. Course work includes a survey of performance manuals, iconographical sources,
and current research; development of editing technique through the preparation of transcriptions; and an opportunity to perform on representative musical instruments of the period, notably the organ, harpsichord, lute, viols, recorders, cornets, and trombones. 2 or 4 credits.

A study of performance practices in solo keyboard works, sonatas a 2 and a 3 and solo cantatas, circa 1640 to 1750, concentrating on ornamentation, realization of figured basses, improvisation, articulation, rhythm, keyboard registration, and the influence of the construction of baroque musical instruments (including the organ) on sonority and technique. Course work includes an examination of manuscripts (on microfilm), prints, treatises, and iconographical sources and the editing and realization of selected works for recital performance. 2 or 4 credits.

An intensive examination of musical styles, circa 1760 to 1815, through the performance of keyboard music and instrumental chamber music, emphasizing the relationship between structure and interpretation, late eighteenth century conventions of ornamentation and articulation, a survey of tutors and relevant theoretical writing, and a critique of currently published editions and editing techniques. 2 or 4 credits.

759, (759). Performance Studies in Nineteenth Century Music
The art of performing and coaching Lieder, piano music, and instrumental chamber music from Schubert through Debussy, with special consideration given to effective ensemble, traditions of interpretation, and the influence of structure on performance. 2 or 4 credits.

760, (760). Performance Studies in Twentieth Century Music
Performance of representative twentieth century compositions for small instrumental or vocal-instrumental ensemble, with intensive work in structural analysis, rhythmic ensemble coordination, dynamic and articulation control, new instrumental techniques, notation, improvisation, and the interaction between jazz and European styles. 2 or 4 credits.

Theory and Composition (71)

471-472. Theory I
Introduction to the tonal system: a study of the principles of voice-leading and harmonic progression through the analysis, realization, and composition of one-, two-, and four-voiced textures. The concept of triad inversion as well as the consonant diatonic harmonies of the major and minor modes are covered. Three weekly recitation sections devoted to compositional and analytic work and two weekly lab sections devoted to development of aural skills are required of each student. Prerequisite: permission of instructor. 4 credits.

571-572. Theory II
A continuation of Music 471-472. Compositional and analytic work stresses the treatment of dissonance within the tonal system; accessory tones, seventh chords, tonicization, modulation, the basic principles of chromatic harmony, and the harmonization of chorale melodies are covered. Appropriate aural skills are stressed in two weekly lab sections. Prerequisite: Music 472 or permission of instructor. 4 credits.
Music

771-772. Counterpoint
A study of the contrapuntal techniques of tonal music. Principles of melodic construction and of dissonance treatment are introduced through work in species counterpoint and studies in harmonic elaboration and prolongation. Analysis of selected compositions emphasizes the connection between fundamental contrapuntal techniques and the voice-leading of composition. Prerequisite: Music 572 or permission of instructor. 2 credits.

773. Canon and Fugue
A continuation of Music 772. The procedures of polyphonic tonal textures are studied through the analysis and composition of canons and fugues. Prerequisite: Music 772 or permission of instructor. 2 credits.

775-776. Composition
An introduction to compositional problems. The student constructs phrases, periods, and short compositions following classical models. Problems of text-setting are covered. Prerequisite: Music 572 or permission of instructor. 2 credits.

777-778. Advanced Composition
A continuation of Music 776. The student works on individual compositional projects in an idiom appropriate to his interests and abilities. Prerequisite: Music 776 and permission of instructor. 4 credits.

779. Orchestration
The characteristics of band and orchestral instruments both individually and in small (homogeneous) and large (mixed) groupings. Students will be expected to study appropriate scores, to write arrangements utilizing these various groupings, and to have these arrangements performed if at all possible. Some aspects of vocal writing will also be covered. Prerequisite: Music 572 or permission of instructor. 4 credits.

781. Form and Analysis
A consideration of various formal and textural elements both as concepts and within the context of musical examples. Thorough analysis of smaller and larger masterworks from the standpoint of harmony, counterpoint, structural line, and formal articulation. Prerequisite: Music 572 or permission of instructor. 4 credits.

785. Electronic Sound Synthesis
A practical course in the creation of sounds by electronic and computer synthesis. The course will be divided into three sections. Part I will deal with "traditional" or "analog" electronic sound synthesis with students having the opportunity to work with the Buchla Synthesizer in the UNH Electronic Music Studio. Part II will deal with the following areas of computer sound synthesis: (1) elementary programming in FORTRAN, (2) the logic of computer sound synthesis, and (3) programming in MUSIC4BF. Students will have the opportunity to run programs on the IBM 360/50 Computer and its associated 12-bit digital/analog converter. Part III will be devoted to supervised independent study in one or both of the above areas. Prerequisite: permission of instructor. 4 credits.

Music Education (72)

540. Beginning Techniques in Voice
This course is designed to develop the basic techniques of voice production. Individual work is emphasized. A working knowledge of an instrument is re-
Music

required. This course is desirable for but not restricted to music education majors. Prerequisite: permission of instructor. 2 credits.

545, 546. Beginning Techniques in String Instruments
Class and individual instruction on stringed instruments, students are expected to practice four hours per week as a basic course requirement. Students will receive training on the violin, viola, and cello. The course will explore classroom procedures, the establishment of string programs, and the evaluation of available methods materials. 2 credits.

595. Special Projects in Music Education
A course to allow an undergraduate to undertake individual investigation, research, or study in any aspect of music education in which he has particular need or interest. Projects of a creative nature may be included. Prerequisite: permission of instructor. 2-4 credits.

741-742. Techniques and Methods in Choral Music
A lecture-workshop course concerning problems in the organization and performance of high school, college, and community choruses. Emphasis is placed on techniques of choral conducting and rehearsal, repertory, and materials. 2 credits.

743. Materials and Methods in Piano Music
A course designed to give potential piano teachers a coherent but flexible approach to the instruction of students of different ages and levels of talent through evaluation of methods and materials and discussion of the role of the private teacher. 2 credits.

745-746. Techniques and Methods in String Instruments
Class and individual instruction on stringed instruments, students are expected to practice four hours per week as a basic course requirement. A high level of instrumental proficiency results from intensive training on the violin, viola, cello, and double bass, enabling participants to perform in string ensembles. The course will explore classroom procedures, the establishment of string programs, and the evaluation of available methods materials. 2 credits.

747-748. Techniques and Methods in Woodwind Instruments
Basic fundamentals of performance in woodwind instruments, techniques of class instruction, associated acoustical problems, and study of woodwind literature. Emphasis in the first semester will be on clarinet, flute, and saxophone. The double reed instruments will be emphasized in the second semester. 2 credits.

749-750. Techniques and Methods in Brass Instruments
A basic course in embouchure formation, tone, tonguing, fingering, flexibility, accuracy, and range development as applied to the trumpet or baritone horn, French horn, and trombone, in conjunction with a survey of the methods, studies, solos, and ensembles most likely to be useful with grade school, junior high school, and high school players of brass instruments. Qualified advanced students may elect honors work in composition, arranging, and ensemble coaching. 2 credits.

751. Techniques and Methods in Percussion Instruments
The basic skills necessary for performance on snare drum, tympani, mallet instruments and the other percussion instruments used in bands and orchestras. Materials and methods of instruction are included. 2 credits.
Nursing

785. Music for the Elementary Classroom Teacher
For the non-specialist interested in utilizing music in the classroom. The correlation and integration of music in the school curriculum, and the basic skills and techniques necessary. 4 credits.

787. The Teaching of Elementary School Music
Aims, scope, and organization of materials and activities in the elementary schools. Modern trends in educational philosophy, development of the child's voice, and demonstration of materials and methods for the various grades. Observation and teaching in schools. Seminar and laboratory. 2 credits.

791. The Teaching of Secondary School Music
The application of educational principles to the teaching and learning of music and the organization of the music curriculum on the junior and senior high school levels. The adolescent voice, the classification of voices, the selection of vocal and instrumental materials, and the building of unified concert programs. Problems of administration, management, and the relationship of the teacher to school and community. Observation of music programs in secondary schools. 2 credits.

796. Organization and Administration of School Music Groups
Problems of organizing and administering school orchestras, bands, glee clubs, choruses, and small ensembles, such as objectives, motivation, schedule, discipline, equipment, programs, finances, rehearsal techniques, contests and festivals, materials, personnel selection, and grades. 4 credits.

Nursing (38)
Chairman: Carol J. Gray

PROFESSOR: Carol J. Gray
ASSOCIATE PROFESSORS: Mary Louise Fernald, Marguerite Fogg, Ann Kelley
ASSISTANT PROFESSORS: Delores Bowers, Meigs Dickman, Virginia Higbie, Martha Rowe, Rosemary Wang, Nancy Watkins
INSTRUCTORS: Barbara Cavenaugh, Evelyn Fitzpatrick, Sandra Hooper, Juliette Petillo, Elizabeth Vittands

504. Fundamentals of Nursing
Course focuses on the basic professional skills which will be needed by the nurse. Emphasis is placed on skills of observation and communication, on interviewing with a purpose, and on understanding basic dynamics of behavior related to illness and disability. A. Kelley. 2 lectures; 1 laboratory; 4 credits.

601. Medical-Surgical Nursing
A combined clinical nursing and theory course which provides opportunity for planning and giving nursing care to meet needs of individuals with health problems and for observing and participating in various health services with multidisciplinary health workers. A course designed also to study some of our society's major health problems and departures from normal physiological function. Health maintenance and prevention of illness will be stressed. Nursing faculty. Prerequisite: Nursing 504. 6 lectures; 2 laboratories; 12 credits.
602. Family Nursing
A course designed to provide the students with the opportunity to gain new knowledge and skill as well as adapting previous learning in giving total family health care. A broad focus enables the student to demonstrate personal and professional responsibility in a relationship with individuals and families. Focus is on maintenance of health through infancy, childhood, adolescence, and childbearing, stressing developmental tasks of each age. Clinical experiences use local hospitals and community agencies. M. Fogg. Prerequisite: Nursing 601. 5 lectures; 4 laboratories; 12 credits. (Variable credits for registered nurses who pass challenge examinations for this course.)

621-622. Mental Health-Psychiatric Nursing
This course is designed to provide the student with information and clinical experiences in the area of mental health-psychiatric nursing. The nursing process is studied in relation to the care of patients coping with stress and maladaptive patterns of behavior, and opportunity is provided for the development of psychiatric nursing knowledge and skills. Emphasis is placed on the nurse's role as a therapeutic agent; preventive, rehabilitative community and family aspects of care as they relate to the therapeutic process are studied. Clinical learning experiences are provided in community and institutional settings. M. Dickman, D. Bowers. Prerequisite: Nursing 602. 2 lectures; 1 laboratory; 4 credits.

631-632. Community Nursing
The nursing process applied to care of patients and families in the home and community. Concurrent with 621-622 and building upon knowledge from all previous nursing courses, this course enables the student to add new knowledge in the field of Community Nursing and to practice new skills in this area. Opportunities will be provided for students' involvement in community health programming. A variety of community health agencies and other health facilities are used for practice and observation. N. Watkins. Prerequisite: Nursing 602. 2 lectures; 1 laboratory; 4 credits.

701-702. Contemporary Problems
An opportunity for the student to reassess, broaden, and integrate her nursing knowledge by an organized study of contemporary nursing practices and their implications for the role of the nurse and the nursing process. Emphasis is placed on the personal and professional responsibilities of the graduate nurse. Opportunity will be provided for students to apply theoretical knowledge to contemporary nursing roles. Nursing faculty. Prerequisite: Nursing 602. 3 lectures; 4 credits.

Ocean Engineering
See Interdisciplinary Programs and Options, page 129.

Oceanography
See Interdisciplinary Programs and Options, page 128.
Occupational Education

Occupational Education (23)
Program Supervisor: William H. Annis

PROFESSORS: Samuel Hoitt, emeritus; Maynard Heckel
ASSOCIATE PROFESSORS: William H. Annis, Jesse James
ASSISTANT PROFESSOR: Nicholas L. Paul
THOMPSON SCHOOL PROFESSOR: Paul A. Gilman
THOMPSON SCHOOL ASSOCIATE PROFESSOR: Lewis Roberts

402. Fabrication Technology
A study of welding, cold-metal working, sheet-metal working, wood working, and plastics in relation to the building or repair of structures and machines. Prerequisite: permission of instructor, 2 recitations; 2 laboratories; 4 credits.

550. Principles of Occupational Education
The technical and professional qualifications of teachers of occupational education and the Cooperative Extension Service. The federal and state legislation affecting these programs at the local level. Two field trips to schools and/or extension meetings are required. 4 credits.

650. Micro-Teaching in Vocational Education
The organization and presentation of micro-lessons to provide preliminary experience and practice in teaching. Students are exposed to the variables of classroom teaching under controlled conditions. Each student is required to teach five lessons in his subject-matter area to small groups of students. Video taping is utilized for immediate feedback. Required for majors and minors in Occupational Education. Prerequisite: Education 481 and 657 or permission of instructor. 4 credits.

696. Field Experience
Field work with an agency, institution, or organization to gain technical and/or professional competence not otherwise available. The student will plan this experience with his departmental adviser. Approval of credit will be subject to recommendation of faculty members and performance of student. Limited to Occupational Education majors and minors. Permission required. 2-16 credits. (May be repeated up to 16 credits.)

750. Shop Organization and Control Methods
Shop organization and control methods to promote efficiency in the control of instruction, equipment, and materials. 4 credits.

783. Preparation for Conducting and Supervising Adult-Education Programs
The techniques of adult education in terms of identifying needs, program planning, methods of teaching, supervision, and evaluation. Prerequisite: Occupational Education 550 or permission of instructor. 4 credits.

784. The Community-Junior and Vocational-Technical Colleges
A study of the rise and development of the community-junior college and the two-year vocational-technical college in American education; their history, potential, philosophy, and functions. 4 credits.

785. Advanced Methods and Materials of Instruction
The organization of instruction to meet individual and student needs; development and use of resource files and instructional materials. Evaluation in teaching occupational education. Open to teachers of vocational-technical education and others by permission of instructor. 4 credits.
786. Concepts of Occupational Education
The development of vocational-technical education in the United States with emphasis on the socio-economic influences responsible for its establishment. The federal and state requirements for programs on the secondary and post-secondary schools will be discussed. Coordination of programs with general education and other vocational fields. 4 credits.

791. Planning for Teaching
The organization of materials of instruction to meet group and individual needs. Techniques of instruction, planning for teaching, the function of consulting committees, working with youth groups, and program evaluation. This course is scheduled concurrently with Education 658, 659, and 694. Prerequisite: Occupational Education 650. 4 credits.

An opportunity is provided for a student to study a special problem in one of the areas listed. Elective after consultation with the instructor. Hours to be arranged. May be repeated. 2 to 4 credits.

798. Occupational Education Seminar
Study of research and development in Occupational Education includes student and faculty presentations and discussions. Required of Occupational Education majors. 0 credits.

Occupational Therapy (39)
Chairman: R. Virginia Bell

ASSOCIATE PROFESSOR: R. Virginia Bell
ASSISTANT PROFESSORS: Laurel G. Bunker, Marjorie B. Dussault, Jessica Siegars
INSTRUCTORS: Judith Ward, Kathryn M. Whitman
MEDICAL LECTURERS: William Amman, M.D., Ear, Nose, Throat Conditions; Luigi N. Dolecino, M.D., Psychiatry; Allan W. Handy, M.A., Pathology; Charles H. Howarth, M.D., General Medicine and Surgery; Gerald Shattuck, M.D., Pediatrics; Ingvars J. Vittands, M.D., Orthopedics; Paul C. Young, M.D., Pathology
ASSOCIATED PRE-CLINICAL FACILITIES: Manchester Rehabilitation Center, New Hampshire Hospital, Danvers State Hospital

The following courses are for occupational therapy students; elective for others by permission of the department chairman.

411. Occupational Therapy Theory I
Developmental concepts and historical perspectives of the basic theories and techniques of occupational therapy. The fundamentals of evaluation, testing, and problem solving; the central role of the patient in planning and administering treatment. Lecture presentations are correlated with clinical observation and supervised clinical participation. Staff. 3 lectures; 1 laboratory; 4 credits.

(412), 412. Activity Analysis
Experience in the analysis of activity and its relationships to physical and emotional aspects of humans. Development of skills in learning, teaching, and super-

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vising activities and activity programs. Staff. Prerequisite: permission of instruc-
tor. 2 laboratories; 2 credits.

(515), 515. Treatment Media I—Crafts
An introduction to craft techniques in selected basic activities, including print-
ing, leather work, and ceramics. The analysis of crafts in relation to their
potential as treatment tools. Methods of teaching basic procedures and skills
to patients. Minimum laboratory fee, §12. Staff. Prerequisite: Occupational
Therapy 411. 2 laboratories; 4 credits.

520. Treatment Media II
A methods and skills course basic to work with patients in the fields of pedi-
atries, geriatrics, physical disabilities, general medicine, surgery, and rehabili-
tation. Developmental activities, activities of daily living, splinting, and adaptive
device construction. Fee for materials. Staff. Prerequisite: Occupational Therapy
411 and 526. 4 credits.

(524), 524. Occupational Therapy Theory II—Psycho-Social Treatment
Methods
The application of psychiatry and psychology to the practice of occupational
therapy with psycho-socially disabled patients. Learning theory, group dynam-
ics, treatment, and rehabilitation techniques. Application of theory and train-
ing in evaluative techniques is presented and practiced in the clinical setting.
Ms. Dussault. Prerequisite: Occupational Therapy 583. 4 credits.

526. Occupational Therapy Theory III—Physical Dysfunction
Basic evaluation and training methods for patients with physical disabilities.
Includes techniques of joint measurement, muscle testing, perceptual motor
development, work tolerance, prevocational testing, methods for developing
coordination and improvement of neuro-muscular patterns of movement. The
importance of providing the patient a wholesome psychological climate condu-
cive to recovery is stressed. Ms. Siegars. Prerequisite: Physical Education 652,
and Occupational Therapy 411 and 584. 4 credits.

(531), 531. Group Process
Dynamics and development of group relationships are studied with emphasis
on self awareness and sensitivity to others. The meaning of group processes in
OT practice, role development and leadership concepts may be explored. Will
be presented as a laboratory or lecture course. Ms. Dussault. 2 recitations; 2
credits.

580. Introduction to Medical Concepts
Introduction to basic concepts of disease and disease processes. A study of
diseases in various systems and of the language of medicine. The importance
of this knowledge in the practice of occupational therapy will be emphasized.
Drs. Allen W. Handy, Paul C. Young, Jr., Charles Howarth; and Virginia Bell,
OTR. Prerequisite: Zoology 508 concurrently and sophomore Occupational
Therapy standing. 4 credits.

(583), 583. Medical Lectures I—Psychiatry
Clinical psychiatric conditions presented by a psychiatrist. Both adult and
childhood disabilities are discussed with patient presentations when possible.
Recitations review and stress those aspects of the material most important in
Occupational Therapy practice. Prerequisite: Child Development and Psychol-
ogy 545. 2 credits.
(584). Medical Lectures II—Physical Dysfunctions
Lecture and clinical presentation of selected medical conditions of primary concern to the occupational therapist. Consideration is given to the etiology, pathology, symptoms, prognosis, and treatment of: pediatric, orthopedic, and neurological conditions. Drs. Gerald Shattuck, Vittands, and Occupational Therapy faculty. Prerequisites: Zoology 507, 508 and Occupational Therapy 411 and 580. 4 credits.

627. Occupational Therapy Theory IV—Advanced Physical Dysfunction
Muscle reeducation techniques used in treating patients with orthopedic and neurological disabilities. Cerebral palsy, polio, amputees, muscular dystrophy, spinal cord injuries, and degenerative neurological conditions are presented and discussed, as are the basic principles of the application of therapeutic exercises, prosthetic training, and the facilitation techniques of Bobath, Rood, Knott, Brunstrom, and Fay. Ms. Siegar. Prerequisites: Neurology, Occupational Therapy 526 and 584. 4 credits.

698. Senior Seminar
A two-semester discussion seminar which will consider topics including senior thesis, research methods, supervisory and consultive functions of the OTR, community practice, professional relationships, administrative procedures, and selected current professional issues. Staff. Prerequisite: senior standing in the major. 4 credits.

Philosophy (73)
Chairman: Duane Whittier

PROFESSORS: Donald C. Babcock, emeritus; Asher Moore
ASSOCIATE PROFESSORS: Paul Brockelman, Robert P. Sylvester, Duane Whittier
ASSISTANT PROFESSORS: Frank Birmingham, R. V. Dusek, Robert C. Scharff
INSTRUCTOR: Judith Lunsford Bangs

405, (405). The Philosophic Dimension
The effort of the course is to give the student a self-contained experience of authentic philosophic thought. Under critical guidance, students are encouraged to reflect on their own experience philosophically and to compare their reflections with those of others. Advanced students act as workshop leaders and tutors. They are available to guide the less experienced into the philosophic dimension, to show them how to use the tools of philosophic inquiry, and to evaluate their work. One lecture per week, plus a core of reading, provide a common groundwork upon which individual students and groups can build. Open only to freshmen and sophomores. 4 credits.

406, (406). The Philosophic Dimension
In format Philosophy 406 is identical to 405 and meets for the same weekly lecture, but workshops and tutorials are distinct. Open only to juniors and seniors. 4 credits.

410, (410). Introduction to Philosophy
An examination of representative philosophies and of some of the persistent problems of philosophy. An introductory course designed to acquaint the student with the nature of philosophy and to help him think about his experience philosophically. 4 credits.
415. Explanation
What are we doing when we give an explanation? Are there different kinds of explanation involved in, e.g., history, social and natural science, literature, economics, philosophy? What are the limits of any given type of explanation? 4 credits.

495. Tutorial Reading
Reading of selected books under the direction and guidance of a member of the Department of Philosophy. The books offered for tutorial reading may be in any area the instructor chooses. Open normally to freshmen and sophomores only. Tutorial Reading may be offered on an independent study basis with permission of instructor. 4 credits.

510. Philosophy of Religion
A philosophical study of the nature and significance of religious experience, with historical and systematic analysis of such traditional problems of philosophical theology as faith and reason, evil, and the existence of God. A part of this course will consist of an intensive phenomenological study of the religious experience and an attempt to deal with the traditional problems from this point of view. Not open to freshmen. 4 credits.

512. Logic and Scientific Method
A course in the logic of science and mathematics. The problems of induction and the paradoxes of logic are emphasized. The nature of probability logic and the character of axiom systems are treated in relation to the methodology and foundations of the empirical sciences. The course is especially suggested for students who are familiar with elementary mathematics (algebra, calculus, or Mathematics 420). Freshmen who have had calculus in high school or who have permission of the instructor may elect the course. 4 credits.

520. Introduction to Oriental Philosophy
A philosophical introduction to the systems of ideas in the Orient (Hinduism, Buddhism, Confucianism, Taoism, etc.). Not open to freshmen. 4 credits.

522. Philosophy of Art
The nature of art; the nature of creation and appreciation; the art media; judgments of worth; the relation of expression, form and subject; the relevance of aesthetic experience to the larger philosophical picture. Not open to freshmen. 4 credits.

530. Ethical Theories
The problems of moral philosophy through the critical examination of important traditional and contemporary theories of ethics. Not open to freshmen. 4 credits.

535. Social and Political Philosophy
An examination of the distinctively philosophical problems encountered in social and political philosophy through the study of representative figures in the history of this branch of philosophy. An essential aim of this course will be to bring the student to serious and intensive reflection upon his own social and political philosophy. Not open to freshmen. 4 credits.

545. Semantics: The Philosophy of Language
The meaning of meaning, the nature of linguistic communication, the nature of truth, the various functions of language, and the role of symbols in science, art, myth, and ritual. 4 credits.
550. Symbolic Logic
The principles and techniques of modern logic, with special attention to their philosophical significance. Discussion of sentential calculus, class calculus, truth tables, and lower functional calculus as well as the nature of deductive systems and the problems of formal consistency. 4 credits.

570. Ancient Philosophy
The beginnings of western philosophy and the great philosophers of Greece and Rome. Prerequisite: permission of instructor. 4 credits.

575. Philosophy of Education
An introductory philosophical study of the nature, significance, and place of education within the human condition. The fundamental purpose of this course is to help each student begin to work out and articulate his or her own attitude toward the basic issues which lie at the heart of education at all levels. Although this course is open to any undergraduate without prerequisite, it is especially aimed at those students who want to explore or intend to enter the field of education and who seek to broaden their understanding of the purpose and significance of education. 4 credits.

580. Modern Philosophy
Western philosophy from the Renaissance through the eighteenth century. Prerequisite: Philosophy 570. 4 credits.

600. Philosophy Through Literature
The philosophical implications of representative literary works with particular emphasis on recent and contemporary literature. 4 credits.

630. Philosophy of Science
A discussion of various philosophical problems raised by science. For example, the status of theoretical terms, the role of mathematics in science, the nature of scientific concepts of space and time, the relations of science to common sense, the relation of theory to observation, the logic of scientific discovery, the nature of historical changes in scientific world-view, the relation of the logic of science to the psychology and history of science. 4 credits.

650. Studies in Systematic Philosophy
Advanced study of particular philosophic problems. The Department is prepared to offer work in the following problem-areas: religion, logic, scientific method, aesthetics, education, ethics, social and political philosophy, semantics, metaphysics, epistemology, philosophy of history, philosophy of mind. At least one section of Philosophy 650 will usually be offered each semester. The specific subject of a given offering may be ascertained from the departmental office. Barring duplication of subject, the course may be repeated for credit. Prerequisite: advanced standing in philosophy and permission of instructor. 4 credits.

670. Studies in History of Philosophy
Advanced study of individual philosophers, movements, or schools, in the history of philosophy. The department offers work in the following periods: ancient and medieval, rationalism, empiricism, and Kant and the nineteenth century. Work in each of these periods will be offered approximately every third semester. The specific subject of a given offering may be ascertained from the departmental office. Barring duplication of subject, the course may be repeated for credit. Prerequisite: advanced standing in philosophy and permission of instructor. 4 credits.
680. **Studies in Contemporary Philosophy**
Advanced study of contemporary individuals, movements, or schools. The department offers work in the following areas: analytic philosophy, continental philosophy, naturalism. Work in each area is offered approximately every third semester. The specific subject of a given offering may be ascertained from the departmental office. Barring duplication of subject, the course may be repeated for credit. Prerequisite: advanced standing in philosophy and permission of instructor. 4 credits.

699. **Senior Thesis**
Independent work under a faculty adviser culminating in a senior thesis. Open only to philosophy majors with department approval. 4 credits.

795, 796. **Individual Study**
Students who are adequately prepared to do independent philosophical work involving extensive reading and writing may do advanced work on an individual basis. Before registering for this course the student must formulate a project and secure the consent of a member of the department who will supervise his work. Conferences and/or written work as required by the supervisor. Credits to be arranged.

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**Physical Education (40)**

*Chairman: Robert Kertzer*

**PROFESSORS:** Marion C. Beckwith, Evelyn Browne

**ASSOCIATE PROFESSORS:** Caroline Wooster, *emerita*; Katherine Amsden, Gavin H. Carter, Phyllis A. Hoff, Robert Kertzer, Robert E. Wear, Walter E. Weiland

**ASSISTANT PROFESSORS:** Thomas R. Barstow, Gail A. Bigglestone, Karen Hogarth, Elizabeth E. Knowlton, Joyce Mills, Jean M. Morrison, Nancy C. Rupp, D. Allen Waterfield

**INSTRUCTOR:** Donald E. Heyliger

**LECTURERS:** Louis A. Datilio, Jean M. Mead

Faculty from the Department of Intercollegiate Athletics

**PROFESSOR:** Paul C. Sweet, *emeritus*

**ASSISTANT PROFESSORS:** Dwight E. Aultman, Lionel J. Carbonneau, Theodore W. Connor, Irwin T. Hess


**The Major Program**
Prospective physical education majors should refer to page 166 for information regarding the Non-Teacher Certification Degree Option and the Teacher Certification Program.

**The Elective Program**
The Department of Physical Education provides an opportunity for students to participate in an elective activity program in a wide variety of sports, dance, aquatics, conditioning, and gymnastics courses, many of which are offered on a coeducational basis. A student may elect one or two credits of activity coursework per semester.
Courses offered in the fall, winter I, winter II, and spring seasons include: aquatics (basic instruction, diving, senior life saving, water safety instructor, synchronized swimming, and SCUBA), archery, badminton, bowling, dance (folk, square, and modern), field hockey, figure control, figure skating, fitness laboratory, foil fencing, general skating, golf, gymnastics, handball, hiking/orienteering, ice hockey, lacrosse, outdoor education, paddleball, physical education activities for children, riding, riflery, skiing, ski conditioning, ski touring, softball, squash, tennis, trampoline, volleyball, weight training.

The Department supplies special uniforms. Students are required to furnish such items as sneakers and bathing caps. A $35 fee is charged for riding and SCUBA; fees are also charged for off-campus activities such as skiing. Students with physical limitations are encouraged to participate in the program on a modified basis.

Women’s Intercollegiate Sports Program

The purpose of the Women’s Intercollegiate Sports Program is to provide all students, whatever their ability, with the exception of the rank beginner, with the opportunity to practice and/or play in a competitive program designed to provide a representative team to compete against other colleges or universities.

A variety of individual and team sports’ experiences are provided in the eight representative teams: fall—tennis and field hockey; winter—volleyball, skiing, basketball, swimming, and gymnastics; and spring—lacrosse.

Performing Groups

Performing groups, sponsored by the Department of Physical Education, include the Contemporary Dance Group and the Synchronized Swimming Club. These groups are open to all interested students and give annual performances.

Physical Education Activity Coursework

405, 406. Elective Physical Education
Coursework in physical education. Activities selected from sports, dance, conditioning, aquatics, and gymnastics areas. 3 hours; 1 credit. NLG.

407, 408. Elective Physical Education
Courses for students who wish to elect a second credit of activity coursework in a given semester. 3 hours; 1 credit. NLG.

Specialized Physical Education Activity Coursework for Major Students

The major activity sequences for students majoring in Physical Education. For men, the 440 sequence; for women, the 410, 420 sequence. Staff. 3 hours; 1 credit. NLG.

Theory Courses—Physical Education

428. Water Safety Instructors’ Course
Conducted through the auspices of the American Red Cross, the course includes analysis of aquatic techniques and methods of teaching swimming, diving, and lifesaving. Instructor authorization is awarded to candidates who demonstrate a high caliber of personal skill, knowledge, and teaching ability in aquatics. Ms. Hoff. Prerequisite: current senior lifesaving certification. 2 credits.

453. Principles of Physical Education
An approach to the field of physical education and related areas through a study of the evolutionary and historical factors affecting its development from pre-historic times to the present day. The place of physical education in the
Physical Education

academic community and its relation to the aims and objectives of general education, the world of sports, and athletics will be considered. Staff. 4 credits.

510. Medical Aspects of Sports and Physical Education
The etiology, pathology, treatment, and prognosis of sports injuries are discussed and related to preventive measures. The various problems encountered in teaching physical education to the physically and mentally handicapped are related to the different pathologies of each disability. Mr. Aultman. 4 credits.

521. Theory of Coaching Basketball
Theory and practice in the fundamentals of individual offense and defense. The various styles of team offense and defense and rules of the game. Problems in handling and conditioning a team. Mr. Friel. Prerequisite: Physical Education 442. 2 credits.

522. Theory of Coaching Football
Analysis of various systems of play. Instruction in team and individual offensive and defensive fundamentals. The theory and strategy of team play, coaching methods, physical conditioning, and rules. Football staff. Open to physical education majors only. 2 credits.

523. Theory of Coaching Hockey
Theory and practice in the fundamentals of team offense and defense, the fundamentals of each position, coaching methods, physical conditioning, and rules. Mr. Carter. 2 credits.

524. Theory of Coaching Baseball
Theoretical and practical consideration of basic principles of batting and fielding, the fundamentals of each position, special stress on problems of team play, coaching methods, physical conditioning, and rules. Mr. Conner. Prerequisite: Physical Education 441. 2 credits.

525. Theory of Coaching Soccer
Combination of lectures and on-the-field demonstrations to help teachers and coaches view practices and concepts used in modern soccer. Material covered will include the following: fundamental and advanced skills and techniques, offensive and defensive principles of team play, tactical formations and strategy, methods of training and practicing, rules of the game. Mr. Heyliger. Prerequisite: Physical Education 447. 2 credits.

526. Theory of Coaching Wrestling
Theory, practical teaching methods, and the development of advanced skills in an individual sport. The course will emphasize theory and practical application of wrestling skills and techniques from basic maneuvers to the more advanced. The basic objective of the program will be to develop sufficient skills and knowledge to teach and coach wrestling. Mr. Hess. Prerequisite: Physical Education 441. 2 credits.

527. Aquatic Leadership Training
The course is designed to survey the methods, organization, and administration of both American Red Cross and YMCA aquatic programs. Topics covered include methods of teaching swimming, diving, and lifesaving; program planning; officiating; operation and maintenance of swimming pools; camp waterfront; health and safety aspects of the aquatic program; legal problems; skin and SCUBA diving; drownproofing. Mr. Waterfield. Prerequisite: senior lifesaving certificate. 2 credits.
528. **Theory of Coaching Track and Field**
   Instruction and practical demonstration in starting, sprinting, middle-distance and distance running, relay, hurdlung, high and broad jumping, pole vault, shot putting, discus, hammer, and javelin throwing. Methods of preparing contestants for the various events. Mr. Phillips. Prerequisite: Physical Education 443. 2 credits.

529. **Theory of Coaching Gymnastics**
   The theory, practical teaching methods, and officiating of competitive gymnastics. Emphasis will be placed on the construction of gymnastic routines, from the elementary to the international level. Practical work sessions will be held. Mr. Datilio. Prerequisite: Physical Education 444. 2 credits.

530. **Theory of Coaching Swimming and Diving**
   A thorough analysis of the techniques of coaching swimming and diving. Course includes a systematic treatment of the philosophy, historical development, and psychological theories of coaching aquatics. Much emphasis is placed on the mechanical and kinesiological aspects of the competitive strokes and required and optional dives, both low and high board. Mr. Waterfield. Prerequisite: Physical Education 443. 2 credits.

532. **Labanotation**
   The study and practice of recording human movement by the method of Labanotation. Ms. Morrison. Prerequisite: intermediate modern dance or permission of instructor. 2 credits.

533. **Dance Composition I**
   A practical, developmental approach to the process of creating dance. Ms. Morrison. Prerequisite: intermediate modern dance. 2 credits.

534. **Dance Composition II**
   Choreographic methods with an emphasis on the use of music and group design. Ms. Morrison. Prerequisite: Physical Education 533. 2 credits.

540. **Motor Efficiency and Impairment in Children and Adolescents**
   An investigation of motor development and motor behavior in normal populations of children at all age levels; an interpretation of perceptual-motor dysfunction, analysis of perceptual-motor training programs, and determination of the role of movement in cognitive development. Ms. Hoff. 4 credits. (Alternate years; offered in 1973-74.)

551. **Analysis of Rhythm**
   A theoretical consideration of the factors which affect and effect rhythm with application to a variety of media. Ms. Knowlton. 2 credits.

554. **Theory of Teaching Dance**
   A study of the methods, materials, techniques, and theories of teaching dance. The first half of the course covers dance as an art form; the second half, recreational dance. Ms. Morrison and Ms. Hogarth. Prerequisite: beginning, intermediate modern dance; folk, square, and social dance. 2-4 credits.

563. **The Theory of Teaching Physical Education in the Secondary School**
   The implications and practical application of various teaching methods which may be employed in the teaching of Physical Education. A combination of classroom and laboratory experiences will be used. A practicum will be included in selected areas. Ms. Rupp. Prerequisite: a specified activity sequence. 4 credits.
582. Personal and Community Health
The individual aspects of healthful living and the problems of community health as they relate to disease prevention and control. Mr. Wear. 4 credits.

606. Neurology
Practical study of morphology, physiology, and histology of the human nervous system, for students in occupational therapy. Prerequisite: Zoology 508. 4 credits.

620. Physiology of Exercise
The acute and chronic physiological effects of exercise. Emphasis will be on respiration, circulation, and energy metabolism. Lectures will be supplemented by laboratory sessions demonstrating physiological adaptation to the demands of muscular activity. Mr. Kertzer. Prerequisite: Zoology 508. 4 credits.

625. Dynamics of Human Movement
A kinesiological consideration of factors which affect efficiency in human movement. Theoretical and technical information on both cinematographic and non-cinematographic forms of analysis. Laboratory experiences in the analysis of selected movement events and sequences (sports, dance, everyday movement). Ms. Knowlton. Prerequisite: Zoology 507. 2 lectures; 1 laboratory; 4 credits. Not open to students who have taken Physical Education 652.

630. Evolution of Sport
An inquiry into the origins and development of sport as an institution in selected geographical areas of the world. Such topics as: the relationship of sports to war, art, and religion; the ritualistic role of sport in time and place; the historic use of sports by nation are among those which will be discussed. This course is designed primarily for non-major students. Ms. Browne. Open to juniors, seniors, and by permission of instructor. 4 credits.

633. Social Foundations of Sport and Physical Activity
An investigation of the interdependence of human movement experiences, as exemplified in sport, play, and games, and various cultural, subcultural, and social factors. Mr. Weiland. Prerequisite: Sociology 400. 4 credits. (Alternate years; offered in 1972-73.)

635. Contemporary Literature in the Socio-Cultural Aspects of Sport and Play
A selective review of contemporary literature dealing with the socio-cultural aspects of sport and play. The literature will be critically analyzed in light of current theory in sport, play, and related areas of study. Students will have the opportunity to pursue in-depth study in a related topic. Ms. Knowlton. Prerequisite: permission of instructor. 4 credits. (Alternate years; offered in 1973-74.)

637. Sport—An Ethological Approach
A survey of the new science of Ethology (animal behavior). The application of ethological principles to the development and conduct of sports in the world today. The relation of ethological principles to those in other disciplines such as psychology, sociology. There will be guest speakers and class discussion. Ms. Browne. Prerequisite: Sociology 411 or permission of instructor. 4 credits. (Alternate years; offered in 1973-74.)

641. The Dance
A philosophical consideration of the trends in dance as a performing art. Ms. Morrison. 4 credits.

644. Choreography
A theoretical and practical consideration of the creative and aesthetic aspects of the Dance. For those students who have taken Physical Education 533 labora-
tory experiences will consist of advanced choreographic projects. Ms. Morrison. Prerequisite: Intermediate modern dance or consent of instructor. 1 lecture; 2 laboratories; 4 credits.

652. Kinesiology
The science of human motion. Detailed analysis of human muscular anatomy and a consideration of the actions of skeletal muscles in light of recent electromyographic evidence. Application of selected concepts of muscle physiology and biomechanics to physical education activities. Mr. Kertzer and Mr. Aultman. Prerequisite: Zoology 507. 4 credits.

656. Problems of Health Education
A survey of total school health: environment, services, and education. Methods, materials, and principles of teaching school health from kindergarten through grade 12. Open to physical education majors and others by permission of instructor. Staff. 2 credits.

655. Administration of Physical Education in Secondary Schools
Administrative methods in the conduct of physical education, health education, and recreation. The planning of programs and policies in the light of past and present philosophies and in regard to current programs, facilities, equipment, selection of staff, and public relations. Staff. 4 credits.

658. Measurement Procedures in Physical Education
Procedures used in interpretation and administration of measurement techniques in physical education. Essential elementary statistical methods are covered so that measurement data may be scientifically evaluated for application to the program. Ms. Amsden and Mr. Weiland. 4 credits.

692. The Theory of Teaching Physical Education in the Elementary School
The methods, materials, and organization of a comprehensive program of activities for use primarily in the elementary school. Mr. Barstow, Ms. Hogarth, Ms. Mills. 4 credits.

696. Independent Study
An opportunity for students who are Physical Education majors to pursue in depth study with faculty supervision. Staff. Prerequisite: junior standing, approval of the major adviser, and the faculty of the area concerned. 2-4 credits.

697. Senior Seminar in Physical Education
Discussion, analysis and evaluation of current materials, ideas, and problems pertinent to the teacher preparation curriculum. This course is included in the student teaching block. Enrollment in each seminar section is limited to 12 students. Ms. Amsden and staff. Open only to senior Physical Education teacher preparation majors who have been accepted for student teaching. NLG. 4 credits.

730. Curriculum Planning in Physical Education
Study of the criteria and factors involved in the planning and construction of school physical education programs. Mr. Carter. 4 credits.

760. Evolution and Cultural Foundations of Physical Education
A study of evolutionary and cultural forces shaping the conduct and content of physical education programs in selected societies today. The course will give the student an opportunity to explore in depth the field of sport, dance, and physical education in the light of new knowledge in the field of ethology and the behavioral sciences. Ms. Browne. 4 credits.
Physics

775. Perceptual Motor Learning
The variables which affect the learning and performance of skilled activity, including ability and motivational characteristics of the learner, and the processes which enhance skill acquisition. Ms. Hoff. Prerequisite: Psychology 401. 3 lectures; 1 laboratory; 4 credits.

780. Psychological Factors in Sport
An investigation of the factors related to outstanding athletic achievement, the psychological variables involved in competition, and the actions and interactions of sport, spectator, and athlete. Ms. Hoff. Prerequisite: Psychology 401 or Physical Education 775, and permission of instructor. 3 lectures per week; 4 credits.

791. History of Physical Education
A comprehensive history of physical education from ancient Egypt to modern times. Particular emphasis is to be placed on the influences of Greece, Rome, the Renaissance and Reformation periods, and modern European Nationalism. A critical analysis of sequential events and the beliefs of leaders in the development of systems of physical education. Ms. Amsden. 4 credits.

Physics (53)
Chairman: Robert E. Houston Jr.

PROFESSORS: Harry H. Hall, emeritus; Edward L. Chupp, Robert E. Houston, Jr., Robert H. Lambert, John A. Lockwood, Lyman Mower, John E. Mulhern, Jr., William R. Webber
ASSOCIATE PROFESSORS: Roger L. Arnoldy, L. Christian Balling, David G. Clark, Richard L. Kaufmann, Robert E. Simpson
ASSISTANT PROFESSORS: John F. Dawson, Edmond C. Roelof, Harvey K. Shepard, Richard St. Onge, John J. Wright
VISITING ASSISTANT PROFESSOR: Leonard M. Simmons, Jr.

401-402. Introduction to Physics I and II
A broad survey of both classical and modern physics with emphasis on the latter. Designed to enable the student to appreciate the role of physics in the society and technology of today. While emphasis is placed upon the fundamental laws of nature on which all science is based, the interrelationships between other disciplines will be stressed. 2 lectures; 1 recitation; 1 laboratory; 4 credits.

405 (405). Concepts of Physics
A descriptive course investigating a limited number of important physical systems. Emphasis will be placed on how the system is to be investigated and the patterns in which the results fall. The intuitive concepts used in investigations will be traced into their application in modern physics. Every effort will be made to relate the patterns of thought in physics to patterns of thought in liberal arts. Recommended for liberal arts juniors and seniors. 4 credits.

406 (406). Introduction to Modern Astronomy
A brief descriptive course covering contemporary astronomical and astrophysical techniques with a review of current knowledge and theories concerning the solar system, galaxies, and the universe. Recommended for liberal arts and beginning science students. 4 credits.
407-408. General Physics I and II
An elementary course emphasizing mechanics as the foundation underlying all physics; selected topics from electrostatics and electromagnetism are also presented. Prerequisite: Math 427-428 passed or taken concurrently. Physics 407: 3 lectures; 2 recitations; 1 laboratory. Physics 408: 2 lectures; 2 recitations; 1 laboratory; 4 credits.

505. General Physics III
Selected topics from wave motion, kinetic theory, and classical physics. An introduction to the study of systems of many particles. Prerequisite: Physics 408 and Mathematics 527 passed or taken concurrently. 3 lectures; 2 recitations; 1 laboratory; 4 credits.

506. General Physics IV
An introduction to modern physics, including special relativity, the structure of atoms and nuclei, and the basic ideas of quantum mechanics. Prerequisite: Physics 408 and Mathematics 527. 2 lectures; 1 recitation; 1 laboratory; 4 credits.

510. Introduction to Modern Cosmology
Cosmology concerns the structure and history of the universe. This study of cosmology is presented in a manner intelligible to students with only a modest knowledge of mathematics and physics; in particular, calculus is not required. Initially several topics in astronomy are reviewed at an elementary level including the physics of the Sun and stars; the Milky Way; and associated phenomena, external galaxies and astronomical distances, and expansion of the universe. The more recent discoveries concerning radio galaxies, quasi-stellar objects, cosmic black body radiation, x-rays, and gamma rays precede a discussion of Newtonian and general relativistic cosmological models. Some specific models discussed include the steady-state, big-bang theories and matter-antimatter models. Field trips will be taken to nearby astronomical observatories. 4 credits.

602. Thermal Physics
This course will include both a classical and a statistical approach to the subject of Thermodynamics, Kinetic Theory. Prerequisites: Physics 408 or equivalent; Mathematics 528. 4 credits.

605-606. Experimental Physics I and II
Experiments in electrical measurements and circuits, passive and active circuit elements, optics, and atomic physics. Prerequisite: Physics 601 taken concurrently. 2 lectures; 2 laboratories; 4 credits.

607. Physical Optics
The electromagnetic theory of light, interference, diffraction, polarization, related phenomena, and nonlinear optics. Prerequisite: Mathematics 528. 4 credits.

609-610. Experimental Physics III and IV
Work of a project nature. Special problems are assigned to the individual student. Prerequisite: senior standing in physics. 2 laboratories; 4 credits.

613, 614. Special Topics I and II
Any selected topics not covered sufficiently well in a general course may be studied. Prerequisite: senior standing in physics. Variable credits; 1-8 credits.

616. Physical Mechanics I
An analytical treatment of classical mechanics covering the dynamics of particles and rigid bodies. Some specific topics include Newton's laws, conservation theorems, oscillations, central force problem, generalized coordinates, and Lagrange's equations. Prerequisites: Physics 505 or equivalent; Math. 528 passed or taken concurrently. 4 credits.
Plant Science

617. Physical Mechanics II
Selected topics of classical mechanics including wave motion, coupled oscillation, and vector field theory. Prerequisite: Physics 616 or equivalent. 4 credits.

618. Introduction to Solid State Physics
A brief summary of the theory underlying the behavior of solids will be given. Emphasis will be placed on transport theory and the interaction of radiation and matter. The operation of semiconducting and superconducting devices and lasers will be considered. Prerequisite: Mathematics 527, Physics 506, or equivalent. 4 credits.

695-696. Independent Study
Individual study projects in physics under the direction of a faculty adviser. Open only to physics honor students. Variable credits; 1-8 credits.

701. Introduction to Quantum Mechanics
An introduction to quantum mechanics with applications to atomic and molecular spectra. Prerequisite: consent of instructor. 4 credits.

702. Atomic and Nuclear Physics
Natural radioactivity, nuclear reactions and scattering, models of the nucleus, high energy nuclear physics, cosmic rays. Prerequisite: Physics 701. 4 credits.

703-704. Electricity and Magnetism I and II
Foundation of electromagnetic theory, including electrostatics, dielectric theory, electromagnetism, magnetic properties of matter, alternating currents, Maxwell's field theory, and an introduction to electrodynamics. Prerequisite: consent of instructor. 4 credits.

Plant Science (24)
Chairman: Lincoln C. Peirce

PROFESSORS: Ford S. Prince, emeritus; R. Eggert, emeritus; Gerald M. Dunn, Clarence A. Langer, Lincoln C. Peirce, Owen M. Rogers, Douglas G. Routley
ASSOCIATE PROFESSORS: L. J. Higgins, emeritus; James R. Mitchell, Jerry A. Warren, Otho S. Wells
ASSISTANT PROFESSORS: George O. Estes, Yun Tzu Kiang, David Koch, James B. Loy, James E. Pollard

421. Concepts of Plant Growth
Development of genetic and physiological concepts underlying plant growth and response of plants in natural and modified environments. Open to all students. Mr. Estes. 3 lectures; 1 laboratory; 4 credits.

427. Landscaping the Home Grounds
The design and maintenance of small properties with emphasis on the principles of arrangement and the use and identification of plant materials in the beautification of home surroundings. Mr. Rogers. 2 lectures; 4 credits.

522. Environment and Plant Response
Discussion of plant responses to environmental stress considering light, temperature, water, and atmospheric resources; the role of plants in the conservation and efficient utilization of environmental resources; pollution effects on plants. Laboratory will involve instrumental measurement of environmental factors and
plant responses to modified natural and controlled environments, including greenhouse and growth chamber. Mr. Koch. 3 lectures; 1 laboratory; 4 credits.

525-526. Plant Culture—Theory and Practice
The techniques of growing plants outdoors and in the greenhouse. Topics include plant breeding and propagation; insect, disease, and weed control; vegetable, fruit, flower, and lawn culture; and greenhouse practices. Mr. Routley and staff. Not open to freshmen. Prerequisite: permission of instructor. 1 laboratory; 2 credits.

535. Origin and Utilization of Cultivated Plants
The importance of cultivated plants in civilizations from both a historical and a utilitarian viewpoint. Plants and plant products discussed will include cereal and forage crops, temperate and tropical fruits and nuts, vegetables, vegetable oils, dyes, latex products, and fibers. Open to all students. Mr. Loy. 2 lectures; 1 laboratory; 4 credits.

565. Recreational Turf
Management of fine turf grasses and their adaptation for recreational and aesthetic use. Open to all students. Mr. Knoop. 3 lectures; 1 laboratory; 4 credits.

606. Plant Physiology
An introduction to the function of higher plants with an emphasis on water relations; metabolism; growth and development. Botany and Plant Science Staff. Ms. Biggs (Botany) and Mr. Pollard (Plant Science). Prerequisite: Botany 411, 503 or Plant Science 421 and one year of chemistry or permission of instructor. 3 lectures; 1 laboratory; 4 credits.

678. Ornamental Plants
The important ornamental plants, their growth characteristics, culture, and use. Mr. Rogers. Prerequisite: Botany 566 or equivalent. 3 lectures; 1 laboratory; 4 credits. (Alternate years; offered second semester 1974-75.)

695 (695). Topics in Crop Production
Growth, culture, and management of fruit, vegetable, pasture, or grain crops. A flexible course presented in the form of lectures, seminars, readings, and a greenhouse or field project designed to give students practical experience. Prerequisite: Plant Science 421. Staff. 2 or 4 credits.
R-1 Fruit Crops, R-2 Vegetable Crops, R-3 Forage Crops, R-4 Grain Crops.

705. Population Genetics
The population growth and regulation; the distribution of genes in populations; factors affecting gene frequency, such as mode of inheritance, mating systems, mutation, migration, genetic drift, selection, and linkage disequilibrium; genetic load, cost of natural selection, and ecological genetics. Mr. Kiang. Prerequisite: Zoology 604 (Principles of Genetics) and Forest Resources 528 (Applied Statistics I), or equivalents, or permission of instructor. 4 lectures; 4 credits.

708. Plant Nutrition
Nutrient requirements of plants; ion uptake, translocation and accumulation mechanisms; role of elements in metabolic processes. Genetic and environmental factors governing nutrient absorption and composition of plants. Mineral element and soil-plant relationships governing nutrient availability; growth, yield and crop quality as influenced by nutrient status; characteristics and formulation of commercial fertilizers. Laboratory emphasis on analytical procedures and instrumentation for soil and plant tissue analysis. Prerequisites: plant physiology, organic chemistry, soils. Mr. Estes. 3 lectures; 1 laboratory; 4 credits. (Alternate years; offered spring 1974.)
Plant Science

732. Developmental Genetics
Fundamental concepts concerning gene action in relation to development, with emphasis on plant organisms. Topics will include isozymes and differentiation, chromosomal proteins and gene regulation, temporal specificity of gene action, nuclear-cytoplasmic interactions, chemical gradients and gene activation, and gene control of differentiation. Prerequisite: Introductory Genetics and Organic Chemistry or Physiology. Mr. Loy. 3 lectures; 1 laboratory; 4 credits. (Alternate years; offered spring 1975.)

740. Organic Evolution
The synthetic theory of evolutionary processes in the origin of life, species, and higher groups; sources of genetic variability, population structure, causes of evolution; ecological adaptation in animals, plants, and man; evolution of communities; molecular evolution and rates of evolution. Mr. Kiang. Prerequisite: Zoology 604, or equivalent or permission of instructor. 4 lectures; 4 credits. (Alternate years; offered spring 1974.)

762. Plant Metabolism
The function, occurrence, synthesis and degradation of plant constituents. Emphasis is placed on respiration and photosynthesis and the metabolism of nitrogenous and aromatic compounds. Biochemical mechanisms such as those involved in seed dormancy, fruit ripening, and disease resistance are discussed in relation to their roles in plant survival. Mr. Routley. Prerequisite: Biochemistry 751 or equivalent. 2 or 4 credits.

769. Plant Growth Regulators
Study of hormones and plant growth substances; relationship of differentiation and development of plant tissues. Mr. Routley. Prerequisite: plant physiology, biochemistry. 2 lectures; 2 laboratories; 4 credits. (Alternate years; offered fall 1973.)

773. Methods and Theory of Plant Breeding
Theory and use of plant breeding systems with emphasis on quantitative plant improvement. Mr. Peirce. Prerequisites: genetics, statistics. 3 lectures; 1 laboratory; 4 credits. (Alternate years; offered fall 1974.)

776. Radioisotope Techniques for Life Sciences
Fundamental concepts and laboratory practice on the application of radioisotopes to biological systems. Techniques include detection and measurement principles, liquid scintillation spectrometry and autoradiography, gamma-ray spectrometry, radiochromatogram scanning, and tissue distribution of radioisotopes in whole animals. Mr. Estes. Prerequisite: general inorganic chemistry and general physics. 2 lectures; 2 laboratories; 4 credits.

795, 796. Advanced Topics in Plant Science
A flexible course structure permitting independent research, study or group discussion of advanced technical or scientific topics. Students should consult with appropriate course coordinator before registering. 2 or 4 credits. R-1 Physiology—Mr. Estes, Mr. Koch, Mr. Pollard, Mr. Routley; R-2 Genetics—Mr. Dunn, Mr. Kiang, Mr. Peirce, Mr. Loy, Mr. Rogers; R-3 Plant Utilization—Staff.
Political Science (75)
Chairman: Bernard K. Gordon

PROFESSORS: John T. Holden, emeritus; Robert B. Dishman, Bernard K. Gordon, George K. Romoser
ASSOCIATE PROFESSORS: David L. Larson, Lawrence W. O'Connell, John H. Woodruff, Frederic W. Wurzburg
ASSISTANT PROFESSORS: Robert E. Craig, Joseph P. Ford, John R. Kayser, David W. Moore, B. Thomas Trout, Susan O. White
INSTRUCTOR: Warren R. Brown

Except for the introductory courses (401 and 402), Political Science offerings are listed by fields at the 500, 600, and 700 level. For detailed information and guidance on these designations see the Political Science description in the catalog section, " Majors in the Bachelor of Arts Program." Generally, courses numbered " 500" in each field are prerequisite to further courses in that field, courses numbered " 600" and above are not open to freshmen; and courses numbered " 700" are not open to freshmen and sophomores. Seminars ( 790-799) are open only to seniors. Courses relevant to more than one field are cross-listed; courses listed with an asterisk (*) may not be taught each year.

401. Introduction to Political Science
The nature of politics and political science, including its vocabulary and purpose. Attention to political institutions, thought, ideologies, and behavior, as well as behavior among levels of governments. Required of all majors in political science. 4 credits.

402. American National Government
The institutions and processes of national government in the United States, but including political behavior at the local and state levels. Required of all majors in political science, except by waiver after successful completion of an examination prepared and administered by the Department, and successful completion of Political Science 531. 4 credits.

Political Thought (Courses numbered 500-519; 600-619; 700-719)

501. Political Thought and Political Action: Introduction to Political Philosophy
An examination of the relationship between philosophy and politics. The course will consider the theoretical assumptions of political life, as reflected in the thought of Plato or Aristotle; Machiavelli; Hobbes or Locke; Rousseau or Nietzsche; Hegel or Marx. Attention will be given to illustrations of political movements, including the ideological attempt to combine theory and practice. Prerequisite for majors: 401 and 402 (or 531), and required of majors intending further study in this field. Not open to freshmen except by instructor's permission. 4 credits.

Intermediate and Advanced Courses in Political Thought. Prerequisite for majors: Political Science 501; for non-majors: a previous course in Political Science, or, with the consent of the instructor, successful completion of a course in a related field. 600-level courses not open to freshmen; 700-level courses not open to freshmen or sophomores.
Political Science

600. Classical and Medieval Political Thought
The development of western political thought. Intensive study of Greek, Roman, and medieval thinkers, including Socrates, Plato, Aristotle, Cicero, St. Augustine, St. Thomas. 4 credits.

601. Post-Renaissance Political Thought
The development of modern conceptions of politics, and the philosophical premises upon which those theories are based, as reflected in the work of major theorists from Machiavelli through Rousseau. 4 credits.

602. Contemporary Political Thought and Ideologies
Major thinkers from Hegel and Marx to the present, with emphasis on the genesis of contemporary ideologies. 4 credits.

*603. The Development of American Political Thought
The basis and development of American political thought, including the contributions of the Colonial experience, Puritanism, revolutionary theories, the constitutional debate, the slavery issue, the frontier mentality, and the emergence of an industrial society. 4 credits.

*621. Logic of Empirical Inquiry
(See listing under Scope and Methods.) 4 credits.

700. Political Thought and Culture
The relation between man’s artistic and social endeavors and forms and his political thought. Study of politics and literature through figures such as Aristophanes, Swift, Shakespeare, and contemporary writers. 4 credits.

701. The Scientific Study of Politics: Its Philosophical Development
An analysis of scientific political science, considering formulations and criticisms of this approach. The course begins with Aristotle, and reviews the development of modern scientific method from Bacon to the present. 4 credits.

*702. Ideologies and Dissent in America and the West
Movements of commitment, dissent, and protest since the late nineteenth century, particularly attacks upon liberal theory and practice in America and Europe. 4 credits.

797, 798. Section 1: Seminar in Political Thought
Advanced treatment and individual research in Political Thought. Not open to freshmen, sophomores, or juniors. 4 credits.

Scope and Methods (Courses numbered 520-529; 620-629; 720-729)
Intermediate and Advanced Courses in Scope and Methods.

*621. Logic of Empirical Inquiry
The empirical mode of procedure for analysis and explanation of political reality. Prerequisite for majors: 401 and 402 (or 531); for non-majors, consent of instructor. 4 credits.

*720. Methods of Research in Political Behavior
Methodology and techniques in evaluating political behavior, surveys, experimental designs, and basic data processing. Aspects of computer technology and political research. 4 credits.

701. Scientific Study of Politics: Its Philosophical Development
(See listing under Political Thought.) 4 credits.

252
732. The Psychology of Political Behavior
   (See listing under American Politics.) 4 credits.

793. Contemporary Political Analysis
   Various forms of contemporary political analysis, with attention both to methods
   of empirical inquiry and explanation and to modes of justification. Intended for
   advanced students; normally open to seniors and graduate students only, except
   upon permission of instructor. 4 credits.

American Politics (Courses numbered 530-549; 630-649; 730-749)

531. American Public Policy
   Attention to major problems facing American policy-makers today, with emphasis on the processes by which institutions and groups resolve and deal with such issues as urban decline; crime, unemployment; civil rights. Prerequisite for majors: 401 and either 402 or successful completion of an examination (prepared and administered by the Department) dealing with the institutions of American government. Required of majors intending further study in American politics. 4 credits.

   Intermediate and Advanced Courses in American Politics. Prerequisite for majors: Political Science 531. For non-majors, a previous course in Political Science, or, with consent of the instructor, successful completion of a related course in another field. 600-level courses not open to freshmen; 700-level courses not open to freshmen and sophomores.

630. State Government and Politics
   Comparative analysis of the environment and workings of American state politics. Attention to state legislatures, bureaucracies, interest-group influence, and problems of taxation. 4 credits.

631. Local Government and Politics
   Theory, structure, and politics of American local government, including municipalities, counties, and special districts. Attention to community decision-making, political participation, and selected policy areas such as land-use control and taxation. 4 credits.

632. American Presidency
   Role and powers of the American presidency in domestic and foreign affairs. The president as administrator, policy-maker, and political leader. Executive-Congressional relations. 4 credits.

633. American Congress
   Structure, powers, and decisional processes of the American Congress. Attention to committee structure, representational roles, legislative oversight and party cleavage. 4 credits.

634. Political Parties and Voting Behavior
   Functions, organization, operation, and bases of electoral support of American political parties. 4 credits.

635. The Politics of Crime and Justice
   Criminal justice under various legal institutions. Contemporary role of police, prosecutors, judges, juries, counsel, and interest groups in the legal process. 4 credits.

636. Supreme Court and the Judicial Process
   The Supreme Court as interpreter of law and arbiter among forces in American politics. 4 credits.
Political Science

730. Administrative Process
The administrative and bureaucratic process in public life. Principal concepts of administration and the relationship of group behavior and policy development to the administrative process. 4 credits.

731. Urban and Metropolitan Politics
Planning and management of the urban community. Attention to intergovernmental relations, administrative functions, and general urban problems. 4 credits.

732. Psychology of Political Behavior
Cultural, social, economic, and emotional forces molding the citizen's political activity. 4 credits.

733. Intergovernmental Relations and Federalism
Interrelationship of national, state, and local governments in the context of the American federal system. Patterns of regionalism, interstate cooperation and conflict, and the evolution of federal relations. 4 credits.

734. Election Practicum
Analysis of the electoral process with field work in political campaigns. Not offered every year. Permission of instructor. 4 credits.

735. American Pluralism
Analysis and critique of theories of American pluralism. Attention to the role of private power in American politics and alternative elitist models of decision making. 4 credits.

758. Comparative Judicial Process
(See listing under Comparative Politics.) 4 credits.

759. Comparative Legislative Behavior
(See listing under Comparative Politics.) 4 credits.

797, 798. Section 2: Seminar in American Politics
Advanced treatment and individual research in American Politics. Not open to freshmen, sophomores, or juniors. 4 credits.

797, 798. Section 6: Seminar in Public Administration
Advanced treatment, including opportunities for direct observation of governmental administration. Not open to freshmen, sophomores, or juniors. 4 credits.

Comparative Politics (Courses numbered 550-569; 650-669; 750-769)

551. Comparative Politics
Introduces concepts, approaches, and problems of comparing political systems, using case studies from several modern foreign governments. This course deals not only with the varieties of contemporary comparative political analysis; but also with the wide varieties of political action and policy choice in the world today. Prerequisite for majors: Political Science 401 and 402 (or 531), and required of majors intending further study in comparative politics. Not open to freshmen except by permission of instructor. 4 credits.

Intermediate and Advanced Courses in Comparative Politics. Prerequisite for majors: Political Science 551. For non-majors: successful completion of a course in Political Science, or, with consent of the instructor, successful completion of another course in a related field or discipline. 600-level courses not open to freshmen; 700-level courses not open to freshmen and sophomores.
650. Democratic Systems
Major governments, including but not restricted to those in Western Europe, characterized by parliamentary and other forms of competitive politics. 4 credits.

*651. Developed and Modern States
Comparative political analysis of major "advanced" states characterized by industrialization and complex organization, with emphasis on but not restricted to such states as US, USSR, Japan, Germany, France. 4 credits.

652. Dictatorship and Totalitarianism
Contemporary and other twentieth century governments characterized by executive dominance and other forms of non-competitive politics, with special emphasis on Nazi Germany and the Soviet Union under Stalin. 4 credits.

653. Developing Nations
Comparative analysis of politics in selected modernizing states in Africa, Latin America, Asia, Middle East. 4 credits.

Area and Functional Studies in Comparative Politics. Courses listed below, in two groups, are open (upon consent of the instructor) to seniors and juniors who have completed one or more courses in foreign-area studies in another department, and to seniors and juniors majoring in Political Science who have successfully completed Political Science 551. Majors are advised to select courses in approximately equal proportion from Group A and Group B.

A. AREA STUDIES

*750. Politics in West Europe
Examination of the politics of major continental powers. 4 credits.

*751. Major Commonwealth States: Britain, Canada, Australia
Comparison and analysis of major governments influenced by the British parliamentary system, but with special emphasis on the nature of federal systems and ethnic diversity as illustrated, for example, with regard to French Canada. 4 credits.

752. Politics in the USSR and East Europe
Comparative analysis of the background, structure, and underlying issues of the political systems of the Soviet Union and selected East European states. Includes examination of ideological bases and political history as well as contemporary trends. 4 credits.

753. Major Governments of East Asia: China and Japan
4 credits.

*754. Government and Politics in the Middle East
4 credits.

*755. Government and Politics in Southeast Asia
4 credits.

797, 798. Section 3: Seminar in Comparative Politics of Nations
Advanced treatment and individual research on the politics of one of the nations or regions listed above (e.g., France, China, Germany, USSR, Southeast Asia). Not open to freshmen, sophomores, or juniors. 4 credits.

B. PROBLEMS IN COMPARATIVE POLITICS AND DEVELOPMENT

757. Political Development and Political Decay
Issues and concepts of political change. 4 credits.
Political Science

758. Comparative Judicial Processes
Comparative court systems and their relationships to political life; political, social, and structural influences on judicial behavior; law and human behavior. 4 credits.

*759. Comparative Legislative Behavior
Role, organization, operation, and conduct of legislatures in various national political systems. 4 credits.

*760. Comparative Communist Systems
Use of comparative methods in analysis of selected aspects of communist systems. Emphasis on interest groupings, elites, and decision-making. Attention to political behavior within communist international organizations and to intra-party distinctions between ruling and non-ruling communist parties. 4 credits.

*761. Political Sociology
The impact of social structure and change upon political behavior, including elite/mass relationships, integration and instability. Attention to major empirical findings and theoretical contributions, from Marx and Weber to the present. 4 credits.

797, 798. Section 4: Seminar in Comparative Politics
Advanced treatment and individual research on theoretical problems and aspects of comparative politics, normally in the fields of administration, foreign policy, political parties, and governmental institutions. Not open to freshmen, sophomores, or juniors. 4 credits.

RELATED COURSES

779. Foreign Policies in Europe
(See International Relations.) 4 credits.

780. Foreign Policies of the USSR and Soviet Bloc
(See International Relations.) 4 credits.

781. International Politics in East Asia
(See International Relations.) 4 credits.

International Politics

571. Introduction to International Politics
Key concepts associated with the causes of international conflict and efforts to prevent conflict and war. The development of a system of nations, behavior of nations, and issues that relate to that behavior in the contemporary world. Prerequisite for majors: Political Science 401 and 402 (or 531), and required of political science majors intending further study in international politics. Not open to freshmen except by permission of instructor. 4 credits.

Intermediate and Advanced Courses in International Politics. Prerequisite for majors: Political Science 571; for non-majors: a previous course in Political Science, or, with consent of the instructor, successful completion of a course in a related field. 600-level courses not open to freshmen; 700-level courses not open to freshmen and sophomores.

672. Foreign Policies of Major Powers
The interaction of national policies, with emphasis on a comparison of major powers' national interest and objectives. Includes, among other techniques, the use of internation simulation as a means to better comprehend national behavior.
673. The Foreign Policy Process of the United States
The institutions and interests that shape and administer American foreign policy, including their historical development, with special attention to the President and his National Security Council; the Congress; and the major agencies involved both here and abroad. 4 credits.

674. Contemporary Issues in American Foreign Policy and World Politics
The problems, and the policies to meet them, in which the United States is involved with other major powers. 4 credits.

775. Theories of International Politics and Integration
Examination of general explanations for the behavior of nations and of the theory and practice of supra-national integration. The development of theories of international peace and security, with attention to the concept of linkage between domestic and international politics. Concepts and practices of arms limitation and conflict resolution and of integration and community-building at the international level. 4 credits.

*776. Strategy and National Security Policy
Defense and deterrence considerations among the United States and other major powers, including consideration of the levels of armed violence affecting international politics, changes in the nature of war, including impact of modern weapons systems and corollary arms limitation problems. Attention also given to the development of defense policy and the role of armed force establishments in shaping defense policy in the US and elsewhere. 4 credits.

*777. International Law
Formalized processes for regularizing state behavior, as reflected especially in the development of norms based on custom, precedent, and formal institutions, as in treaties and cases. Attention given to arms reduction and limitation arrangements; inspection; and other formal procedures designed to preserve peace. 4 credits.

*778. International Organization
Collective security and other forms of cooperation among nations through international organizations such as the United Nations and its predecessors, and through regional bodies. 4 credits.

*779. Foreign Policies in Europe
The interaction of major European states, with attention to East-West relations, security alliances, forms of economic and political cooperation, and the impact of domestic change and superpower relationships on international politics in Europe. 4 credits.

780. Foreign Policies of the USSR and the Soviet Bloc
The development of Soviet foreign policy and strategy in its national and European coalition context, with attention to Soviet-American and Sino-Soviet relations. 4 credits.

781. International Politics of East Asia
Foreign and defense policies of the major East Asian states, with emphasis on Japan, China, and selected Southeast Asian nations. Special attention to the issues and problems where the separate states' interests interact. 4 credits.
Psychology

797, 798. Section 5: Seminar in International Politics
Small-group discussion, including individual research, on problems in international politics, with emphasis on developments in theory. Not open to freshmen, sophomores, or juniors. 4 credits.

Portuguese
(See Spanish and Classics)

Psychology (76)
Chairman: Gordon A. Haaland

PROFESSORS: Herbert A. Carroll, emeritus; George M. Haslerud, emeritus; Raymond L. Erickson, Frederick M. Jervis, Eugene S. Mills, John A. Nevin, Robert I. Watson

The listings below are general descriptions of the courses. In many instances various sections of a course may differ from one another in both content and instructional methods. The student is referred to the Instructors' Course Descriptions published by the department each semester for specific details about each section. Listings will be made available in departmental offices prior to and during the preregistration period.

General Courses

401. Introduction to Psychology
Psychology as a behavioral science with emphasis on both its theoretical and applied aspects. This is a prerequisite for all other courses in the department, except with permission of the Department Chairman. Offered both semesters.
To actively experience the nature of psychological research, the student is expected to serve as a subject. 4 credits.

545. Clinical Approaches to Human Behavior
The dynamics of normal and abnormal behavior are considered from the viewpoints of Freud, Rogers, learning theorists, existentialists, and others. The emphasis is distinctly on human behavior and attention is given to clinical procedures of evaluating and modifying behavior. No training in the use of clinical techniques is given. The emphasis is on familiarizing the student with the nature of the clinical approach. Prerequisite: Psychology 401. 4 credits.

575. Development of the Normal and Exceptional Child
The behavioral and psychological development of children from the prenatal period through adolescence. Topics include intellectual, social, personality, and physical development with discussion of major theorists and current findings in these areas. The exceptional child is discussed in terms of characteristics, causation, adjustment problems, and educational requirements. Areas of exceptionality include giftedness, retardation, physical handicaps, and emotional disturbance. Prerequisite: Psychology 401. 4 credits.
589. Special Topics
New or specialized courses are presented under this listing. Taught by different staff members each year. The instructor presents material in an area of psychology which is not normally covered in regular course offerings. Descriptions of course(s) to be taught under this listing will be on file in the Psychology offices during registration. Prerequisite: Psychology 401. 4 credits.

Major Courses

601. Statistics and Methodology in Psychology
Introduction to the uses of statistical analysis and experimental methodology in psychological research. The major goal of the course is to aid students in understanding the basic statistical and procedural considerations involved in answering questions in psychological research. Substantive problems are emphasized as illustrations of typical applications. Prerequisite: Psychology 401. 4 credits. Required of all undergraduate majors and minors in psychology.

602. Experimental Psychology
The application of experimental methods to a variety of psychological phenomena with emphasis on the principles of experimental design and methods of data analysis. In addition to participating in and writing up a sequence of basic laboratory experiments, each student will be responsible for conceiving, conducting, and reporting an original experiment. Prerequisite: Psychology 601. 4 credits.

751. Psychology of Personality
An examination of the major theories of personality regarding questions of the acquisition, maintenance, and modification of individual behavior. Relevant research as well as the nature of theorizing is also considered. Prerequisite: Psychology 601. 4 credits.

752. Social Psychology
The behavior of individuals is studied as it is affected by the behavior of other individuals, by groups, and by society. Topics typically discussed are attitude change and social influence, conformity, social interaction, and research, though other types of data are regularly introduced. Prerequisite: Psychology 601. 4 credits.

753. Abnormal Psychology
This course will examine various kinds of disturbing behaviors in terms of: (1) historical developments; (2) viewpoints of etiology; (3) identifying and understanding disruptive behavior; and (4) diagnostic implications for treatment as a function of varying theoretical viewpoints. Prerequisite: Psychology 601. 4 credits.

758. Psychology of Learning and Motivation
The roles of learning and motivation are studied in relation to contemporary theories of behavior and integrated with other areas of psychology. Emphases are on theory, research methods, and applications. The major concepts and most recent research findings in the areas of learning and motivation are discussed. Prerequisite: Psychology 601. 4 credits.

778. Brain and Behavior
The study of relationships between the nervous system and behavior. The course examines the physiological, neural, and biochemical mechanisms underlying instinct, memory, learning, emotion, and consciousness in man, as well as the evolution of these functions in lower animals. Prerequisite: Psychology 601. 4 credits.
Recreation and Parks

794. The History of Psychology: An Integration
This course provides an opportunity for the psychology major to reassess, extend, and integrate his knowledge of psychology within a historical perspective. Attention is given to antecedents in philosophy and the physical sciences and their relationship to the subsequent development of schools and systems of psychology. In addition, the course examines contemporary thought and research in the field. Normally taken during the senior year. Prerequisite: 20 major credits in psychology or permission of instructor. 4 credits.

Special Courses

701, (701). Contemporary Topics in Psychology
A non-credit seminar focusing on topics of particular interest to students in psychology. Jointly organized by students and faculty to respond to request of students. Prerequisite: Psychology 401. 0 credit.

789, (789). Advanced Topics
The instructor presents advanced material in an area in which he has developed specialized knowledge through research and study. Taught by different staff members each year. Students may repeat the course, but may not duplicate areas of specialization. Descriptions of courses to be taught under this listing will be on file in the Psychology offices during registration. Section One would be offered every semester as a seminar focusing on contemporary topics which signal new directions for psychology. An attempt will be made to broaden the scope of psychology by considering the limitations of the traditional questions asked by behavioral scientists and the methods they use and by exploring recent developments in theory and method. Prerequisite: 16 credits of psychology or permission of instructor. 4 credits.

795, (795). Independent Study
This course provides the opportunity for a psychology major to pursue independent study with a member of the faculty. 1) Physiological, 2) Perception, 3) History and Theory, 4) Learning, 5) Social, 6) Cognition, 7) Statistics and Methods, 8) Experimental, 9) Personality, 10) Developmental, 11) Counseling, 12) Psychotherapy. Arrangements are to be made with a specific faculty member and enrollment is by permission only. 14 credits.

Recreation and Parks (41)
Chairman of Program: Gus C. Zaso

ASSOCIATE PROFESSOR: Gus C. Zaso
ASSISTANT PROFESSOR: Charles A. Lewis, Jr.
LECTURERS: Wayne W. Justham, C. Michael O’Neil
VISITING LECTURER: Arthur H. Mittelstaedt, Jr.

400. The Impact of Leisure in Contemporary Society
An examination of major factors and trends which contribute to the emergence of a leisure-oriented society; significant problems which accompany the expansion of leisure opportunities; and relationships of leisure to the varieties of human activity. 4 credits.
454. Organized Camping
The organization and supervision of public, private, and commercial camps; program planning; selection of staff; and environmental-resources development. 4 credits.

455. (455). Introduction to Recreation and Park Services
An integrated view of the leisure movement with a general introduction to the objectives and processes for portraying the role of recreation and parks in contemporary society. 4 credits.

457. Dynamics of Leadership and Programming
A presentation and review of leadership theories and techniques and their relationship to principles of planning and evaluating leisure-oriented activities and programs. 4 credits.

560. Introduction to College Union and Campus Recreation Services
Management and operation of college unions and campus recreation resources as functions of service in higher education. Weekly laboratory experience is required as it relates to the administrative process. 4 credits.

564. Field Work in Recreation and Park Services
To provide a learning experience in the practice of supervision, administration, and/or planning principles and techniques designed to test and to contribute to the theory of practice. Prerequisites: Recreation and Parks major and permission of instructor. NLC. 48 credits.

643. Comparative Environmental Education
A course that evaluates the interdependent relationships which exist between living things and the natural environments on a comparative basis. Resident laboratories will be held in natural learning areas such as the pond, salt marshes, the seashore, and the mountain forests. Emphasis will be placed on skills, techniques, and methods of ecosystem analysis with application to recreation and educational situations. 4 credits.

644. Outdoor Education
The elements of organization, administration, and programming as they relate to the school curriculum and school camping. Concepts and processes will be illustrated and applied through outdoor laboratory experience. 4 credits.

661. Recreation Resources Management
An examination of park practices as they relate to location, management, and maintenance. Special consideration will be given to small urban parks. 4 credits.

663. Recreation and Park Administration
A critical analysis of theoretical and practical methods utilized in attaining leisure-oriented public and private organizational goals. Prerequisite: permission of instructor. 4 credits.

667. Recreation and Resource Planning
An introduction to local, regional, and state planning concepts which relate to open space, parks, conservation, and preservation. 4 credits.

668. Designing and Engineering Facilities and Areas for Recreation
The processes, principles, procedures, and practices involved in designing and engineering indoor and outdoor recreation facilities. 4 credits.
Military Science

670. (670). Independent Study in Leisure Services
Individual study and/or research relating to a broad range of leisure-oriented subjects. Prerequisites: senior classification and 2.5 cumulative grade point. 1-4 credits.

671. Legal and Financial Aspects of Leisure Services
A review of the basic legal and financial aspects of leisure-oriented services with special attention directed toward establishing systems and departments, powers, operations, federal regulations, tort liabilities, and technical assistance programs. 4 credits.

698. Seminar in Leisure Problems, Trends, and Research
Preparation and presentation of position papers and research reviews which relate to problems, trends, and current practices. Prerequisite: Senior classification or permission of instructor. 4 credits.

Reserve Officers Training Corps
Department of Military Science (98)

PROFESSOR OF MILITARY SCIENCE: Colonel Herbert H. Flather, Infantry
LECTURERS: Lieutenant Colonel Wilfred W. West, Signal Corps; Major Robert C. Goff, Armor; Major James J. Jameson, Air Defense; Captain Edward J. Haydash, Infantry
ADMINISTRATIVE: Sergeant Major Paul V. Boals; Master Sergeant Andre J. St. Laurent;
Staff Sergeant Robert R. Cordell; Mr. N. E. Bernier, Property Officer

In line with the present review of Military Science courses, where possible, regular academic offerings are being substituted for military courses. Substitute courses are being introduced on a sequential basis.
Courses follow the student's normal academic progression; e.g., 400 series are freshman courses; 500 series sophomore courses; 600 series junior courses; and 700 series senior courses.

411, 412. Fundamentals of Military Science I
The organization of the United States defense establishment and its role in national security. Practical training in leadership and command, marksmanship, and military drill to provide a balanced picture of the mission of the Army and an introduction to the military program. 1 lecture; 2 credits toward Army officer commission.

521, 522. Fundamentals of Military Science II
Operations of the basic military team to include military geography and the use of maps and aerial photographs. The functions, duties, and responsibilities of junior leaders. Continuing development of leadership through practical exercises. 1 lecture; 2 credits toward Army officer commission.

523. American Military History
A study of the development of American military institutions, policies, experience, and traditions in peace and war from Colonial times to the present. Emphasis will be on the relationship between the military and other aspects of American society and the role of the military in the establishment, expansion, preservation, and development of the nation. 3 lectures; 4 credits to be arranged.
Civil Engineering 501. Surveying
A course for non-civil engineering students in the theory and use of tape, level, transit, and aerial photographs in making plane and topographic surveys. Use of surveys as a basis for deeds, maps, construction design, and reports involving the use of land or other natural resources. (Optional course for portions of 521, 522.) 2 lectures; 2 laboratories; 4 credits.

633. Professional Development
Military instruction for two hours each week plus a four-credit academic subject which, in the opinion of the student's academic adviser and the Professor of Military Science, will contribute to the cadet's potential as a prospective Army officer. The academic subject will be a specific year course in history or political science and may be completed in the junior year, senior year, or a combination of both. The academic subject may be an elective or one that is required in the student's normal academic curriculum. Military instruction, a prerequisite for cadet subsistence pay and commissioning, will include leadership laboratory and branches of the Army. The combined course of instruction outlined above must provide for a minimum of five hours of instruction per week. Course requirements are satisfied by completion of the elective course and leadership laboratory. NLG.

634. Military Leadership and Command
The principles of leadership. The theory and practice of military teaching methods. Small unit tactics. Military communication facilities. Leadership laboratory to include exercise of command of small units. 3 lectures; 1 laboratory: 3 credits toward Army Officer Commission.

743. Fundamentals and Dynamics of the Military Team
The concept and fundamentals of Army administration, military law, the Army-readiness program, the position of the United States in the contemporary world scene, and the impact on leadership and management problems of the military services. An overview of Army organization and a general concept of the teamwork involved in military operations to include duties in the division staff, military intelligence, staff planning, operations, administration, logistics, and staff recommendations. Emphasis will be placed on decision making, command control, communications, and the principles of internal defense development. Leadership laboratory to include practical application of leadership principles and exercise of command. 3 lectures; 1 laboratory; 3 credits toward Army officer commission.

744. Professional Development
Military instruction for two hours each week plus a four-credit academic subject which, in the opinion of the student's academic adviser and the Professor of Military Science, will contribute to the cadet's potential as a prospective Army officer. The academic subject may be an elective or one that is required in the student's normal academic curriculum. Military instruction, a prerequisite for cadet subsistence allowance and commissioning, will include leadership laboratory, obligations and responsibilities of an officer, and world change and military complications. The combined course of instruction outlined above must provide for a minimum of five hours of instruction per week. Course requirements are satisfied by completion of the elective course and leadership laboratory. NLG.
Aerospace Studies

Department of Aerospace Studies (99)

Professor of Aerospace Studies: Colonel Vincent S. Cahill, Jr. USAF
Lecturers: Major Darrel D. Lynch, USAF; Major Paul T. West, USAF; Captain Richard A. Wadsworth, USAF
Administrative: Technical Sergeant Jerome P. Barton, USAF; Technical Sergeant Thomas W. Wassmann, USAF; Staff Sergeant Herbert Campbell, USAF

415. United States Military Forces
Introduction to the organization, mission, and doctrine of the U. S. Air Force. Examines the role of the Air Force in relation to other branches of the armed forces. Emphasis is on civilian control of the military and our strategic offense forces. 1 recitation; 1 credit toward Air Force officer commission only.

416. United States Military Forces
Introduction to major Air Force commands and the functions of each. Examination of the roles of separate operating agencies. Emphasis is on the organization, systems, and operations of general purpose and aerospace support forces. 1 recitation; 1 credit toward Air Force officer commission only.

535. Introduction to World Politics
AFROTC students should select Political Science 571, Introduction to International Politics, to fulfill this course requirement. If for some reason a student cannot elect Political Science 571 before the end of the sophomore year, Political Science 401, Introduction to Political Science, fulfills minimum course requirements. 4 credits.

536. United States Defense Policy
Introduction to national objectives and the making of United States defense policy. Considers factors of national power and the role of the armed forces as an instrument of national policy. Acquaints students with the defense policies of major world powers. 1 recitation; 1 credit toward Air Force officer commission only.

635. Concepts of Management
This course focuses on the characteristics of the organization. An attempt is made to draw on existing theory to provide the student with a conceptual framework useful in analyzing and administrating various types of organization: e.g., business, educational, medical, and social. Participation in class discussions of cases and written commentary on theoretical readings are required. Occasional field work may be anticipated. AFROTC students elect Administration 411, Behavior in Organizations, to fulfill this course requirement. 4 credits.

636. Space Operations
Course describes basic laws, principles, and operations of aeronautical and space systems. Emphasis will be on the concept of the physical laws rather than in-depth mathematical rigor. Offered jointly by the College of Technology (Technology 422) and AFROTC as a team-taught course required for AFROTC cadets and elective for all students. Technology staff. 2 recitations; 4 credits.

745. Development of Aerospace Power
A course designed to develop an understanding of the use of aerospace forces as a primary element of our national security organization. Emphasis is on the concepts governing the employment of aerospace forces and the technological factors affecting these forces. Contemporary thoughts on Air Force organization,
mission, readiness, and capabilities are aired in student-led seminars. 2 recitations; 4 credits.

746. Concepts of Air Force Leadership
Defines the meaning of military professionalism, responsibilities of the profession, responsibilities of the professional officer, and his role in the military service. Emphasis is on development of leadership skills in student-led seminars. Includes discussion of the military justice system. 2 recitations; 3 credits.

Resource Economics
(See Institute of Natural and Environmental Resources)

Russian
(See German and Russian)

Sanskrit
(See Spanish and Classics)

Secretarial Studies (33)

ASSOCIATE PROFESSORS: Doris E. Tyrell, emerita; Myra L. Davis

401-402. Shorthand
Principles of Gregg shorthand with practice in transcribing from shorthand plates and class notes. Prerequisite: proficiency in typing or Secretarial 405 or 407 which must be taken in conjunction with this course. 4 credits.

405 (405). Personal Use Typewriting
Practice in acquiring correct typing techniques, arranging letters, outlines, notes, themes, bibliographies, and simple tabulations. Open to any student who does not know how to typewrite. 5 laboratories; 2 credits. NLG.

407-408. Typewriting
Practice in acquiring correct typewriting techniques and in arranging letters, tabulations, and simple manuscripts. Prerequisite: permission of instructor. 5 laboratories; 2 credits. (See Secretarial 427).

427. Typewriting
Practice in acquiring correct typewriting techniques, and in arranging letters, tabulations, and simple manuscripts. This course is to be taken instead of Secretarial 407 by students who have had Secretarial 405 or the equivalent. Prerequisite: Secretarial 405 or equivalent and permission of instructor. 5 laboratories; 1 credit.
The courses are given under the auspices of the Division of Social Science of the College of Liberal Arts.

681 (681). Internships
Field work in a department, agency, or institutional setting of the state or local government, or in a selected and approved private agency. The work will be under the supervision of the department or agency to which the student is appointed. The chairman of the department involved or his representative will be responsible for arranging the student’s individual internship program. Pre-requisite: internships for seniors only may be approved by the departments of History, Political Science, Psychology, or Sociology and Anthropology, or the Whittemore School of Business and Economics. Not more than 16 credits.

697, 698. Social Science Colloquium
A seminar devoted to the study of the social sciences. The unique aspects of political science, psychology, sociology, economics, and history are emphasized, as well as interdisciplinary implications, through extensive written work and discussions. Limited to Ford Foundation scholars. 4 credits. NLG.

Sociology and Anthropology (82)
Chairman: Walter Buckley

ASSOCIATE PROFESSORS: Melvin T. Bobick, Peter Dodge, Richard E. Downs, Bud B. Khleif, Arnold S. Linsky, Melville Nielson, Frederick Samuels, Pauline Soukaris
ASSISTANT PROFESSORS: Thomas Burns, Howard Shapiro
INSTRUCTORS: Charles E. Bolian, Loren Cobb, Thomas J. Vicarro

Anthropology

411. Cultural and Social Anthropology
An introduction to Cultural and Social Anthropology, emphasizing their distinctive approaches to the study of human behavior and development as disciplines. Analysis of selected social institutions, forms of social structure, and language as they relate particularly to non-literate societies. A number of the latter will be studied in detail. 4 credits.

412. Physical Anthropology and Prehistoric Archaeology
An introduction to man’s physical evolution and his cultural prehistory as well as the techniques involved in both. 4 credits.

512. Introduction to World Ethnography
Primarily for sociology majors and minors but also for those with a general interest in sociology or anthropology. Selected studies of peoples in the major ethnographic areas of the world. Particular attention will be paid to historical and geographic factors involved in these areas, types of social and economic
organization, and problems involved in the comparative study of human societies and institutions. Prerequisite: Anthropology 411 or equivalent, or permission of instructor. 4 credits.

514. Method and Theory in Archaeology
Basic method and theory in archaeology; techniques used by the archaeologist in recovering and interpreting data; laboratory exercises to familiarize the student with ceramic and lithic analysis. Students learn to evaluate archaeological literature critically, using skills acquired in the course. Prerequisite for area courses in archaeology. Prerequisite: Anthropology 412 or permission of instructor. 1 2½-hour class per week. 4 credits.

614. Economic Anthropology
The economic organization of primitive and peasant societies, focusing on such problems as: social organization of production and distribution, economic surplus, concepts of property, markets, and development. Prerequisite: Anthropology 411 or permission of instructor. 4 credits. (Offered in alternate years.)

616. Anthropology of Religion
Includes a survey of the major anthropological theories of religion, the analysis of religious beliefs as symbolic systems, and their interrelations with ritual and other social institutions. The religions of a number of societies will be examined in detail. Prerequisite: Anthropology 411 or consent of instructor. 4 credits. (Offered in alternate years.)

618. Political Anthropology
A survey of decision-making processes with emphasis on the differences between systems of consensus as opposed to systems of centralized rule in pre-industrialized societies. Prerequisite: Anthropology 411 or permission of instructor. 4 credits. (Offered in alternate years.)

620. Anthropological Linguistics
An introduction to the nature of language and linguistic analysis. Topics covered will include: the analysis of speech events, the acquisition of language, expressive language, social structure and the speech community, language thought and world view, language origins and history, bilingualism, etc. Prerequisite: Sociology 400 or Anthropology 411 or permission of instructor. 4 credits. (Offered in alternate years.)

731, 732. Area Studies in Archaeology
Courses in the archaeology of different areas of the world will be offered as staff is available and student needs dictate. (1) South America. An introduction to the archaeology of South America beginning with the earliest known remains and progressing up to the level of the various cultural groups which existed at the time of European contact. Particular emphasis will be placed on the changing relationship of culture and environment through time. Prerequisite: Anthropology 412 or permission of instructor.

747. Native Cultures of South America
A survey of the indigenous cultures of South America. Selected groups of people from the major ecological areas of South America will be studied with an emphasis on the relationship of environment and culture. Where there are adequate historical data, changes in culture and social organization since the sixteenth century will be considered. Prerequisite: Anthropology 411 or permission of instructor. 4 credits.
749. Peoples and Cultures of Oceania
A survey of the traditional cultures of Melanesia, Polynesia, and Micronesia in terms of the geographical, ecological, historical, and cultural factors which have influenced their development. Several societies will be selected for detailed examination. Prerequisite: Anthropology 411 or permission of instructor. 4 credits.

751. Peoples and Cultures of Africa
A survey of sub-Saharan African social systems. The stress will be on the analysis of segmentary and non-segmentary systems in terms of their variation throughout the continent. The focus will be on how these societies solve the problems of daily living in terms of the tribe, clan, and lineage. Prerequisite: Anthropology 411 or Sociology 400. 4 credits.

752. Social Problems in Modern Africa
Urban and rural adjustments (acculturation) of tribal systems in Africa (below the Sahara) to the twentieth century. This course is a follow-up of Anthropology 751 although the latter is not a prerequisite. Prerequisite: Anthropology 411 or Sociology 400. A background in sociological theory and methods is desirable. 4 credits.

755. Ethnography of Southeast Asia
A study of the geographical, racial, cultural, and historical factors in the development of the area, together with detailed examinations of selected peoples and aspects of their cultures. Prerequisite: Anthropology 411 or equivalent, or permission of instructor. 4 credits.

775. Anthropological Theory
An examination of the major theoretical approaches in anthropology viewed in historical perspective. Prerequisite: Anthropology 411 or permission of instructor. 4 credits.

795, 796. Reading and Research in Sociology and Anthropology
A student prepared by training and experience to do independent work under the guidance of an instructor may register for one or more of the following sections: (3) cultural/social anthropology, (7) prehistory archaeology, (17) anthropological linguistics. Prerequisite: 12 hours of sociology or anthropology, and permission of instructor. Hours and credits to be arranged.

Social Service

522. Introduction to Social Welfare
A general overview of social welfare: a historical analysis; the study of contemporary social welfare services to include social insurance, public assistance, child welfare, and poverty programs. Correlated to course content will be observational experiences at nearby community agencies. Required for Social Service majors. It is recommended that majors take this course during their sophomore year. Prerequisite: permission of instructor for non-majors. 4 credits.

(622). Social Work Practice
Study of the methods approach to social work practice with emphasis given to basic concepts, principles and techniques of social casework, social group work, and community organization. Required for Social Service majors. Prerequisite: Sociology 522 and permission of instructor for non-majors. 4 credits.

631. Social Welfare Field Experience
To give the student an understanding of social welfare through observation and participation. Social Service majors will be placed in a social welfare setting
for a minimum of 30 full days. This field work may be done either during the summer following the junior year or during the first semester of the senior year; arrangements will be made on an individual basis between faculty adviser and student. Weekly seminar sessions constitute the classroom work of the course. Prerequisite: Soc. 522, 622 and permission of instructor. Does not count for major credit in Sociology. 4 or 8 credits.

795, 796. Reading and Research in Sociology and Anthropology
A student prepared by training and experience to do independent work under the guidance of an instructor may register for the following section: (18) social service. Prerequisite: 12 hours of sociology or anthropology, and permission of instructor. Hours and credits to be arranged.

Sociology
400. Introductory Sociology
Man's social and cultural relationships as revealed in his customs and institutions. Social theory, methods and techniques of research, and current research findings. A section using a laboratory-problem method of instruction is offered from time to time. Students interested in such a research experience should register for the section identified as "Laboratory" in the Time-Room Schedule. 4 credits.

500. Social Psychology
Individual actions, attitudes, ideas, and perceptions as influenced by sociocultural environments. Individual-cultural relations in education, religion, economics, aesthetics, ethics, and deviant behavior. 4 credits.

520. The Family
An anthropological and institutional approach comparing customs and organizations in several societies. Not open to freshmen. A section using a laboratory-problem method of instruction is offered from time to time. Students interested in such a research experience should register for the section identified as "Laboratory" in the Time-Room Schedule. 4 credits.

530. Race and Ethnic Relations
Majority-minority group relations. Special attention is given to the nature and results of Black-White and ethnic group relations in the United States. Not open to freshmen. Prerequisite: Sociology 400. 4 credits.

540. Social Problems
How culture in the form of customs and institutions is related to such human problems as crime and delinquency, alcoholism, physical and mental disease, sex pathologies, poverty, old age, broken families, and racial and religious prejudices. Especially for students who do not intend to major in sociology. Prerequisite: Sociology 400. 4 credits.

560. Rural-Urban Sociology
Application of sociology principles to the study of customs and institutions in rural and urban settings. Differentiation between influences upon community organization of culture on the one hand and population size and density on the other. Prerequisite: Sociology 400. 4 credits.

600. Social Institutions
Involves examining the nature of institutions as distinct from other societal forms, and the relationships among such institutions as education, religion, economy, government, paedotrophic and intersex practices, art, and recreation. A cross-cultural approach will be emphasized. Prerequisites: junior standing,
Sociology and Anthropology

six hours of sociology, declaration of sociology as major, or permission of instructor. 4 credits.

601. Methods of Social Research
Cross-sectional and longitudinal survey design; direct and indirect measurement techniques; design of field and laboratory experiments; special topics. Prerequisite: major in sociology or social service or permission of instructor. 4 credits.

602. Statistics
Elementary applied statistical techniques; descriptive statistics, cross-tabulation, correlation, probability, hypothesis testing, analysis of variance. 4 credits.

611. History of Social Theory
An examination of the background and early formulation of sociological theory. Consideration will be given to the writings of classical social thinkers, Descartes, Comte, and Max Weber, among others. 4 credits.

612. Contemporary Sociological Theory
An exposition of the major schools of contemporary sociological theory: functionalism, "verstehen" sociology, symbolic interactionism, reform sociology, neopositivism, and formal theory construction. 4 credits.

629. Small Groups
Interaction among individuals in small groups and between small groups is examined on the levels of perception, attitude, and behavior. Analytical techniques are applied. A prior course in social psychology is recommended. 4 credits.

695, 696. Honors Seminar
Students work individually on a problem selected by the department member in charge of the seminar. A number of projects are assigned in which emphasis is placed upon the tools of academic research and upon oral and written reports. 4 credits.

697. Junior Tutorial Seminar
A course designed to intensify the intellectual experience of the student and to develop his competence in oral and written presentation. The student will be required to submit several papers or other substantive pieces of work and to engage in discussion and recitation. May be taken either semester of the junior year. Prerequisite: major in sociology; 6 hours of sociology including Sociology 400. (Not offered at present.) 4 credits.

703. Criminology
The scientific study and control of crime. The following are considered: indexes, rates, and theories of crime and delinquency, police, courts, probation, prison, and parole. 4 credits.

720. Current Developments in Sociology of the Family
The theoretical and empirical research on specific aspects of the family. A different topic will be selected each semester to reflect issues of current importance, for example: stratification and the family, intra-family communication, power structure of the family, kinship in modern societies. In addition to critical review of the literature, a class or individual research project will usually be carried out. Prerequisite: 6 credits of sociology, Sociology 520 recommended. 4 credits.
721. Family Interaction
Relationships of family members to one another and the influence of family interaction on human behavior. The interactionist and role approach is used. Research which relates to scientific knowledge of family interaction is analyzed. Prerequisites: 8 credits in sociology and/or psychology; Sociology 500 recommended. 4 credits.

735. Complex Organizations
Analysis of the structure and dynamics of complex, formal organizations (business, military, political and governmental, educational). Emphasis on the construction of theory to account for the findings of empirical studies, both historical and comparative. Special problems treated in the course: power and social control in formal systems; organizational processes, performances, and effectiveness; impact of complex, formal organizations on persons and societies. Prerequisite: permission of the instructor. 4 credits.

740. Culture Change
Various types of society, leading to the development of a theory of culture change. Descriptive studies of institutional as well as theoretical materials selected from the writing of Comte, Marx, Spencer, Durkheim, Spengler, Sorokin, Redfield, and others. Prerequisite: Sociology 400. 4 credits.

741. Social Change and Societal Development
Comparative, interdisciplinary approach to the study of social change. The course focuses on the interrelationships among economic, political, and social factors in determining the structure, dynamics, character, and level of development of societies. Prerequisite: permission of instructor, Sociology 740 recommended. 4 credits.

745. Social Stratification
Nature, functions, patterns, and effects of social stratification. Social mobility. The social class system in the United States. Prerequisite: Sociology 400. 4 credits.

757. Social Institutions of Latin America and the Caribbean
Selective analysis of distinctive institutions and social systems, with particular attention to social aspects of the process of modernization. Prerequisite: permission of instructor. 4 credits.

761. Population Dynamics
Examination of major population trends including changes in birth and death rates, population characteristics, mobility, migration, world population growth, population problems, and policies of countries at different stages of economic development. Emphasis is on the interrelationship of population and society. 4 credits.

770. Culture, Personality, and Society
A cross-cultural view of the development of personality as emergent from the matrix of genetic, situational, and sociocultural determinants; and an analysis of the dynamic interplay of sociocultural and psychological behavior system. Prerequisite: permission of instructor. 4 credits.

780. Social Conflict
The nature of social conflict, especially war. The setting and initiation of conflict, its dynamics, and the factors affecting its course and outcome. Prerequisite: permission of instructor. 4 credits.
Spanish and Classics

785. The Study of Work
This course is centered on the assumption that to understand society, one needs to understand the structure of work. Case studies of high-status and low-status occupations are used as clues to a larger perspective—an awareness of social processes and interrelationships in the social structure. The student is encouraged to study occupations in an ethnographic manner. Graduate students may enroll only with permission of instructor. 4 credits.

790. Applied Sociology
The practical application of sociological research including: (1) current level of use of sociological knowledge; (2) the advocate, consultant, and researcher roles in applied settings; (3) techniques of applied research; (4) implications of applied sociology, including ethical problems. Each student will focus on a social problem of his choice and write a paper covering the above issues. Students will be involved in applied projects where possible. Prerequisite: Sociology 601. 4 credits.

795, 796. Reading and Research in Sociology and Anthropology
A student prepared by training and experience to do independent work under the guidance of an instructor may register for one or more of the following sections: (1) communications, (2) criminology, (3) cultural/social anthropology, (4) culture change, (5) culture and personality, (6) deviant behavior, (7) pre-history archeology, (8) family, (9) population, (10) rural urban, (11) social control, (12) social differentiation, (13) social movements, (14) social psychology, (15) social research, (16) social theory, (17) anthropological linguistics, (18) Social Service. Prerequisite: 12 hours of sociology or anthropology, and permission of instructor. Hours and credit to be arranged.

Soil and Water Science
(See Institute of Natural and Environmental Resources)

Spanish and Classics
Chairman: John C. Rouman

Professors: John S. Walsh, Emeritus; R. Alberto Casás, Warren H. Held
Associate Professors: Richard J. Callau, Charles H. Leighton, John C. Rouman
Assistant Professors: Richard V. Desrosiers, F. William Forbes, Lois Grossman
Instructor: Barbara Wing
Assistant Chairman for Spanish: F. William Forbes

Classics (78)

511-512. Greek and Latin Literature in Translation
A survey of Greek and Latin literature through which the student will be made aware of the dimensions of the ancient Greco-Roman civilization from which so much of our contemporary culture derives. Primarily for the student unprepared to read works in the original Greek and Latin but desiring acquaintance with the subject matter. A background course for majors in such subjects as English, history, Latin, Greek, and the modern languages and literatures. Open to freshmen. 3 recitations; 4 credits.
Spanish and Classics

601-602.  Elementary Sanskrit
Prerequisite: permission of instructor. 3 recitations; 4 credits.

605.  Introduction to Linguistics
A survey of the entire field of linguistics for those interested in learning about
the character of languages. Subjects to be included are comparative linguistics,
a short history of linguistics, phonetics, phonemics, language families, types of
grammars, methods of writing, etc. No prerequisite but some language training
is desirable. 3 recitations; 4 credits.

621-622.  Masterpieces of Greco-Roman Culture in Translation
A more advanced study of the writings of the classical civilizations of Greece
and Rome. Designed for students who have had some preparation in classical
studies and are seeking a deeper acquaintance with the field. A background
course for majors in such subjects as English, history, Latin, Greek, or the
modern languages and literatures. Prerequisite: permission of instructor. Not
open to freshmen. 3 recitations; 4 credits.

695-696.  Honors Work in Classics
For seniors writing a research paper in the honors program in classics. Pre-
require: permission of instructor. 2 or 4 credits.

Greek (79)
New students will be assigned to the proper course on the basis of their scores
on the College Board Achievement test. Transfer credit will not be given for ele-
mentary level college courses in foreign languages if the student had two or more
years of the foreign language in secondary school.

401-402.  Elementary Greek
Grammar, simple composition, and translation. 5 recitations; 4 credits. (May
not be taken for credit by students who had two or more years of Greek in
secondary school).

503-504.  Intermediate Greek
Selected readings from Xenophon, Plato, Herodotus, Euripides, and the New
Testament. Prerequisite: Greek 402. 3 recitations; 4 credits.

601-602.  Greek Prose Composition
A review of Attic Greek grammar; a study of Greek prose style; translation
of English into Greek. Prerequisite: permission of instructor. 3 recitations; 4
credits.

751-752.  Homer and the Archaic Period
Selected readings from the "Iliad," the "Odyssey," the Homeric Hymns, Hesiod,
Pindar, and the Lyric Poets. Prerequisite: permission of instructor. 3 recita-
tions; 4 credits.

753-754.  Athenian Historians
Selected readings from Herodotus, Thucydides, and Xenophon. Prerequisite: permission of instructor. 3 recitations; 4 credits.

755-756.  Athenian Drama
Selected readings from Aeschylus, Sophocles, Euripides, Aristophanes, and
Menander. Prerequisite: permission of instructor. 3 recitations; 4 credits.

757-758.  Athenian Philosophy and Oratory
Selected readings from Plato, Aristotle, Lysias, Demosthenes, and Isocrates. Pre-
require: permission of instructor. 3 recitations; 4 credits.

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Spanish and Classics

795-796. Special Studies in Greek
Prerequisite: permission of instructor. 3 recitations; 4 credits. Examples of topics that may be selected by instructor and student in conference are:

1. Pre-Socratic Philosophers
2. Hellenistic Greek Authors
3. Theocritus
4. Polybius
5. Greek Authors of the Roman Empire
6. Plutarch
7. Septuagint
8. New Testament
9. Greek Church Fathers
10. Byzantine Authors
11. Spoken Greek
12. Advanced Greek Composition
13. Introduction to Classical Scholarship
14. Greek Epigraphy
15. Greek Dialects
16. Comparative Grammar of Greek and Latin
17. Homer: A Linguistic Analysis
18. Greek Institutions
19. Palaeography and Textual Criticism

Latin (80)

New students will be assigned to the proper course on the basis of their scores on the College Board Achievement test. Transfer credit will not be given for elementary level college courses in foreign languages if the student had two or more years of the foreign language in secondary school.

501. Intermediate Latin
Similar to Latin 503 (below), but for students continuing from Latin 402 and students whose preparation does not qualify them for Latin 503. Beginning with an intensive review of Latin grammar and vocabulary, to be followed by readings in prose and poetry, this course prepares students for Latin 504. Completion of Latin 501 will fulfill the foreign language requirement for the B.A. degree. 3 recitations; 4 credits.

503-504. Intermediate Latin
Review. Selected readings from Caesar, Sallust, Livy, Catullus, Horace, Ovid, Plautus, Terence, and Seneca. Prerequisite: Latin 402 or equivalent. 3 recitations; 4 credits.

601-602. Latin Prose Composition
A review of Latin grammar; a study of Latin prose style; translation of English into Latin. Prerequisite: permission of instructor. 3 recitations; 4 credits.

751-752. Cicero and the Roman Republic
Prerequisite: permission of instructor. 3 recitations; 4 credits.

753-754. Roman Historians
Selected readings from Livy, Sallust, and Tacitus. Prerequisite: permission of instructor. 3 recitations; 4 credits.

755-756. Vergil
Prerequisite: permission of instructor. 3 recitations; 4 credits.

757-758. Horace
Prerequisite: permission of instructor. 3 recitations; 4 credits.

759-760. Catullus and Martial
Prerequisite: permission of instructor. 3 recitations; 4 credits.
761-762. Ovid and the Elegiac Poets  
Prerequisite: permission of instructor. 3 recitations; 4 credits.

763-764. Pliny and Statius  
Prerequisite: permission of instructor. 3 recitations; 4 credits.

791. Problems in the Teaching of Latin in the High School  
Prerequisite: permission of instructor. 3 recitations; 4 credits.

795-796. Special Studies in Latin  
Prerequisite: permission of instructor. 3 recitations; 4 credits. Examples of topics that may be selected by instructor and student in conference are:

1. Minor Authors of the Republic  
2. Plautus  
3. Terence  
4. Lucretius  
5. Caesar  
6. Sallust  
7. Minor Authors of the Empire  
8. Ovid  
9. Seneca  
10. Lucan  
11. Quintilian  
12. Persius and Juvenal  
13. Tacitus  
14. Suetonius  
15. Latin Church Fathers  
16. Medieval Latin  
17. Advanced Latin Composition  
18. Introduction to Classical Scholarship  
19. Latin Epigraphy  
20. Italic Dialects  
21. Comparative Grammar of Greek and Latin  
22. Roman Law

Spanish (77)

New students will be assigned to the proper course on the basis of their scores on the College Board of Achievement test. Transfer credit will not be given for elementary level college courses in foreign languages if the student had two or more years of the foreign language in secondary school.

401-402. Elementary Spanish*  
For students without previous knowledge of Spanish. Aural-oral practice, and the study of fundamental speech patterns, reading and writing to achieve a firm basis for an active command of the language. No credit toward a major. 5 recitations; 2 laboratories; 4 credits. (May not be taken for credit by students who had two or more years of Spanish in secondary school.)

403-404. Elementary Portuguese  
For students without previous knowledge of Portuguese. Aural-oral practice and the study of fundamental speech patterns, reading, and writing to achieve a firm basis for an active command of the language. No credit toward a major. 5 recitations; 2 laboratories; 4 credits. (May not be taken for credit by students who had two or more years of Portuguese in secondary school.)

501. Intermediate Spanish*  
Similar to Spanish 503, but for students continuing from Spanish 402 and students whose preparation does not qualify them for Spanish 503. Aural-oral practice, review of the basic structure, reading, and writing to develop an active command of the language. No credit toward a major. Students with a final grade of B or better may register for Spanish 504, with permission of instructor. Com-

* No student educated in a foreign country will be permitted to register for any Spanish course numbered 650 or below if Spanish is the student's native language.
completion of 501 will fulfill the foreign language requirement for the B.A. degree. 5 recitations; laboratory attendance as required; 4 credits.

503-504. Intermediate Spanish*
Intensive and extensive reading of complete texts of intrinsic literary and intellectual worth, formal review of the structure of the language, training in oral and written expression of ideas. Classroom discussion and papers in Spanish. Open by placement examination, and to students who have passed Spanish 402 with a grade of C. Students making a grade of A in Spanish 504 may take courses numbered 750 and above with the permission of the department. 3 recitations; 1 laboratory; 4 credits.

595. 596. Special Topics in Spanish Language, Literature, and Culture*
To be offered in English and in translation. This course will allow students to study a topic or topics not normally offered in the departmental courses. Examples of topics that may be requested: a period, an author, or a genre of Spanish literature in translation; the Hispanic minorities in the U.S.; Latin-American civilization as seen through literature; Don Quixote in translation; Borges; Asturias and the Nobel Prize; Unamuno as Existentialist; Art and Literature in Spain. To the extent possible, this course will be offered in response to student requests. Not available for major credit. May be repeated for credit with permission of instructor. Variable credit, 1 to 4 credits.

605, 606. Introduction to Spanish Literature and Thought*
Reading and analysis of significant works in Spanish literature and thought. Outside readings on the historical and cultural background of the works read. Papers and discussion in Spanish. Term paper in English. This course or its equivalent is prerequisite to all higher courses in Spanish. Open to students who have achieved a grade of C or better in Spanish 504, and by placement examination. Conducted in Spanish. 4 credits.

631, 632. Advanced Spanish Conversation and Composition*
For students who wish to perfect their command of written and spoken Spanish, maintain aural-oral fluency in Spanish through intensive work in and out of the classroom; individual conferences, and laboratory sessions. Prerequisite: Spanish 503 or 504 or equivalent. 3 lectures; 2½-hour laboratory; 4 credits.

665. 666. Spanish American Literature
The main themes of Spanish-American literature studied in the works of its most representative authors and against the historical, social, and geographical background of the New World. Conducted in Spanish. Prerequisite: Spanish 504 or equivalent. Concurrent enrollment in Spanish 631 may be required; consult department chairman. 4 credits.

685-686. Junior Year Abroad
A program of studies at a Spanish or Spanish-American university for juniors who have completed their sophomore year at the University of New Hampshire and have passed Spanish 503-504 or the equivalent with a grade of B or better. The students chosen for the program will be required to take non-credit orientation meetings during the semester prior to departure. Interested students should consult with the directors of the program. Variable credit up to 32 credits. Not offered for graduate credit.

695-696. Honors Work in Spanish
For seniors writing a research paper in the honors program in Spanish. Prerequisite: permission of major supervisor. 2 or 4 credits.
701, 702. Catalan
An introduction to Catalan grammar and literature. Semester I: study of the linguistic elements of Catalan, especially in its contrasts with other Romance languages, and basic readings in Catalan. Semester II: a survey of Catalan literature from the Middle Ages to the present. Prerequisite: completion of an intermediate-level course in Latin or one of the Romance languages, or permission of the instructor. This course does not satisfy the language requirement in the College of Liberal Arts. 4 credits. (Offered alternate years.)

752. Drama and Poetry of the Siglo De Oro
The social background of the Baroque period. Readings of representative plays of Lope de Vega, Tirso de Molina, Calderon, and the poetry of Lope, Gongora, and Quevedo. Development of the prose of the period. Conducted in Spanish. Prerequisite: Spanish 606 or 666 or equivalent. 4 credits. (Offered alternate years.)

754. Cervantes
The development of Cervantes' literary art. Reading and discussion of selections from all the major works of Cervantes. Comprehensive study of the Quijote, its originality and significance; its antecedents; its religious, philosophical and sociological aspects; and its artistic structure. Conducted in Spanish. Prerequisite: Spanish 606 or 666 or equivalent. 4 credits. (Offered alternate years.)

755. Literature of the Nineteenth Century
Readings and discussion of works by significant writers of the nineteenth century in Spain, such as Larra, Espronceda, Bécquer, Pérez Galdós, and Blasco Ibáñez, within the artistic, philosophical, and social environment of the century. Conducted in Spanish. Prerequisite: Spanish 606 or 666 or equivalent. 4 credits. (Offered alternate years.)

757. Theater and Poetry of the Twentieth Century
Critical analysis, reports, and discussion of the major developments in poetry and the drama of the twentieth century, beginning with the Generation of '98. Major writers to be studied will include Benavente, Machado, J. R. Jiménez, García Lorca, Casona, Sastre, Buero Vallejo, Dámaso Alonso, and Miguel Hernández. Conducted in Spanish. Prerequisite: Spanish 606 or 666 or equivalent. 4 credits. (Offered alternate years.)

758. Spanish Prose of the Twentieth Century
Readings and discussion of the novels, short stories, and essays of such major writers of the twentieth century as Unamuno, Baroja, Menéndez Pidal, Ortega y Gasset, Julián Marías, Aranguren, Pérez de Ayala, Gironella, and Cela, as well as a survey of contemporary prose. Conducted in Spanish. Prerequisite: Spanish 606 or 666 or equivalent. 4 credits. (Offered alternate years.)

760. Unamuno and Ortega y Gasset
Critical examination of the philosophical ideology and literary content of the major contributions of Miguel de Unamuno and José Ortega y Gasset. Prerequisite: Spanish 606 or 666 or equivalent, or permission of instructor. 4 credits. (Offered alternate years.)

771. Spanish-American Drama
From pre-Hispanic origins to the present, with emphasis on the modern playwrights of Mexico and Puerto Rico. Conducted in Spanish. Prerequisite: Spanish 606 or 666 or equivalent. 4 credits. (Offered alternate years.)

772. Spanish-American Novel
Development of the genre from Romanticism to present-day writers, with special emphasis on contemporary trends and techniques. Conducted in Spanish.
Spanish and Classics

Prerequisite: Spanish 606 or 666 or equivalent. 4 credits. (Offered alternate years.)

773. Spanish-American Short Story
Development of the genre through study of representative authors, with stress on the twentieth century. Principles of interpretation. Conducted in Spanish. Prerequisite: Spanish 606 or 666 or equivalent. 4 credits. (Offered alternate years.)

774. Spanish-American Poetry
Discussion of major poets from modernismo to the post-Vanguard movements: Dario, Huidobro, Mistral, Vallejo, Octavio Paz. Conducted in Spanish. Prerequisite: Spanish 606 or 666 or equivalent. 4 credits. (Offered alternate years.)

Spanish-Education 791. Problems in the Teaching of Spanish in the High School
The special objectives, methods, and devices of modern language teaching in high school. For prospective teachers of Spanish. Prerequisite: permission of instructor. 4 credits.

795, 796. Special Studies in Spanish Language and Literature
Individual guided study in special topics, with training in bibliography and organization of material. Examples of topics that may be selected by instructor and student in conference are:

1. The history of the Spanish language
2. Medieval Spanish literature
3. Spanish literature of the Renaissance
4. Spanish literature of the Golden Age
5. Spanish literature of the eighteenth and nineteenth centuries
6. Spanish literature of the twentieth century (1898-1936)
7. Contemporary Spanish literature
8. Spanish American literature of the sixteenth and seventeenth centuries
9. Spanish American literature of the eighteenth and nineteenth centuries
10. Spanish American literature of the twentieth century
11. Contemporary Spanish American literature
12. Structural and applied linguistics
13. Spanish Literary Criticism
14. Spanish-American Drama
15. Latin America
16. Linguistic Problems of Disabled Children
17. Major Spanish-American Authors
18. Spanish Poetry
19. Galdos
20. Archtype Latin American Literature
21. Special Teaching Problems
Prerequisite: permission of major supervisor. 2 or 4 credits.
Speech and Drama (83)
Chairman: David J. Magidson

PROFESSORS: Edmund A. Cortez, emeritus; Joseph D. Batcheller
ASSOCIATE PROFESSORS: John C. Edwards, David J. Magidson, Frederick P. Murray
INSTRUCTOR: Carol A. Luchs

Communications

402, (402). Communications I
An analysis of interpersonal and intrapersonal communications. Perspectives from the communications arts and sciences provide a broad theoretical approach. A major goal of the course is the student’s awareness of himself and his role in the process of communication. Two lecture sessions and a 11/2 hour laboratory-discussion section. Team taught; guest lecturers. Open to freshmen and sophomores. 4 credits.

403, (403). Public Speaking
A course in public speaking designed to sensitize speakers and listeners to the process of communication, including understanding and adapting to receivers, idea selection and development, message organization, and delivery. Some examination of nonverbal and other aspects of communication. 4 credits.

405, (405). Debate Workshop
Basic principles of rational decision-making through argumentation. Students apply principles of argumentation in various debate formats. (May be repeated for credit.) 2 credits.

421. Problems in Human Listening Behavior
An analysis of listening processes, evaluation of means by which accuracy in listening can be improved, and the pitfalls which inhibit that accuracy. Practice in various theoretically different listening situations with experimental techniques, where applicable. (Offered in alternate years with Speech and Drama 630.) 4 credits.

501. Argumentation
The study of argument and advocacy as action on minds by means of discourse. Includes such concepts as presumptions, hierarchies, loci, presentation of data and the form of the discourse, ethical and logical duties of the advocate. Students examine arguments by politicians, lawyers, or others who advance propositions of fact, value, or policy. (Alternate years with Speech and Drama 656). Prerequisite: Speech and Drama 405 or permission. 4 credits.

503. Introduction to Group Processes
An examination of communications behavior in small groups. Analysis of problem solving procedures, leadership, behavioral patterns, communications interaction patterns, and other variables related to improved effectiveness in small group participation. Prerequisite: Speech and Drama 402 or 403, or permission. 4 credits.

506. Persuasion
An advanced public speaking course which focuses on the problems associated with influencing human behavior. Assignments are devised to encourage students to utilize principles acquired in the course; for example, persuasive messages on
Speech and Drama

relevant issues, advertising materials and campaign content. Prerequisite: Speech and Drama 403 or permission. 4 credits.

555. Introduction to Mass Communications
The nature, development, and effects of mass communications on our society. Particular emphasis on television, both its effects and techniques of basic television productions. Students will have limited opportunities for studio work. Permission required. 4 credits.

572. General Semantics
The study of the human symbol-using capacity and the effects of language on behavior. Ways in which symbols help create individual realities, reflect levels of personal judgement and adjustment, facilitate or hinder interpersonal communication. Application of course principles to verbal and nonverbal communication, contemporary social issues, etc. 4 credits.

608. Advanced Speech Composition
The development and application of rhetorical strategies in preparation and presentation of messages variously designed for oral delivery. The course operates as a writing and speaking workshop. Recommended: Speech and Drama 403. (Offered in alternate years with Speech and Drama 671). 4 credits.

630. Psychology of Communication
Psychological principles of communication, such as concept-reference, vocal, visual, and verbal cues, as well as attention. (Offered in alternate years with Speech and Drama 421.) 4 credits.

656. Principles of Rhetorical Criticism
A seminar designed to explore the roles and methods of rhetorical critics. Includes historical background to rhetorical-critical structures and processes including neo-Aristotelian criticism, Burkeian criticism, and other contemporary approaches. Provides a broad exposure to critical principles and practices in the area. (Offered alternate years with Speech and Drama 501.) Prerequisite: Speech and Drama 403 or permission. 4 credits.

671. Criticism of Contemporary Rhetoric
Examines the broad range of contemporary rhetorical activities and applies rhetorical-critical systems and principles to the study of those activities. Examples can include: campaign rhetoric, agitative rhetoric, the rhetoric of religion, the rhetoric of militarism, the rhetoric of diplomacy, and the rhetoric of social movements. Course content variable. (Offered in alternate years with Speech and Drama 608). Prerequisite: Speech and Drama 403 or permission. 4 credits.

673. Experimental and Descriptive Studies in Oral Communication
An examination of experimental and descriptive studies in the field of speech, with emphasis upon the theoretical contributions which have evolved from such investigations. 4 credits.

681. Theories of Language
A course which examines the nature, uses, and roles of language from varying perspectives and disciplines. Representative theorists include Carroll, Piaget, Sapir, Whorf, Vetter, Vygotsky, Wiener, Chomsky, Labov, Stewart, Ogden and Richards, Ruesch, and Sullivan. (Offered in alternate years with Speech and Drama 673.) Prerequisite: permission of the instructor or Speech and Drama 572. 4 credits.
695. Special Topics in Communications
Individual or group projects to enrich or expand theoretical or applied experiences, primarily in the Communication option of the Department. By permission and arrangement with appropriate faculty. Variable credits of 2, 4, 6, or 8. (May be repeated to a maximum of 8 credits.)

750. (750). Writing for Performance
See description in Theater offerings. 4 credits.

Communications Disorders

521. Speech and Hearing Science
Anatomical, neurological, and physiological bases of the vocal and auditory mechanisms. A synthesis of the natural and physical sciences needed for human communication. Study of the processes of respiration, phonation, articulation, and audition. Acoustical and physical properties of speech. 4 credits.

524. Applied Phonetics of American English
An introduction to phonetics through use of the international phonetic alphabet primarily in the analysis of the sounds of American English. Study and transcription of American and foreign dialects in conjunction with the professional interest of the student. 4 credits.

602 (602). Special Problems in Communication Disorders
Individual or group projects to enrich or expand theoretical or applied experiences. By permission and arrangement with faculty. Variable credits of 2, 4, 6, or 8. May be repeated to a maximum of 8 credits.

631. Speech Pathology I
An examination of the etiology and treatment of the more common speech disorders. Emphasis is given to speech development, articulation problems, and stuttering. 4 credits.

632. Speech Pathology II
The nature of speech disorders of psychological and physical origin. Identification, case-study method, observations, referral procedures, and rationales for therapy are discussed. Pertinent research is reviewed regarding aphasia, cerebral palsy, mental retardation, and emotional disturbance. Speech/voice/language therapy is considered in an interdisciplinary context. Prerequisite: Speech and Drama 631 or permission of instructor. 4 credits.

634 (634). Clinical Practice in Speech Pathology
Supervised experience in diagnosis and therapy with speech-handicapped children and adults. Discussion and demonstrations of therapeutic procedures and practices. Initial experiences are provided with school-age children with articulation disorders in individual and group therapy. Prerequisites: Speech and Drama 632 and 524. 4 credits.

638. The Acquisition of Language
An examination of some of the research in the fields of speech pathology, linguistics, and learning theory as it relates to the development of language in the normal child. 4 credits.

704. Basic Audiology
Introduction to clinical audiology stressing pure-tone and speech audiometry, the normal hearing process, and pathologies of hearing. Prerequisite: Speech and Hearing Science or permission of instructor. 4 credits.
Speech and Drama

705. Introduction to Auditory Perception and Aural Rehabilitation
Exploration of the research and testing procedures dealing with the phenomenon of auditory perception. Application of this knowledge to the communicatively impaired. Prerequisite: permission of instructor. 4 credits.

Theater

435. Theater and Its Drama I (Introduction to Theater)
Introduction to basic drama and theater theory with emphasis upon modern theater. Survey of theater areas, personnel, and methods. Attendance at University Theater and Allied Arts productions. Minimal participation in laboratory and major productions. 4 credits.

436. Theater and Its Drama II (History of Theater)
Theater and drama-history and theory in its social framework from the beginnings to 1800. 4 credits. (Alternate years.)

438. Theater and Its Drama III (History of Theater)
A continuation of Speech and Drama 436 from 1800 to the present. 4 credits. (Alternate years.)

441. Voice and Diction I
Voice and articulation development with relation to the communication needs of the individual with particular reference to the theater, television, radio, etc. Individual and group practice sessions in addition to regular class meetings. Permission of instructor required. 2 credits.

442. Voice and Diction II
Continuation of 441 with more emphasis upon basic skills for oral interpretation, theater, etc., including analysis and development of dialects. Prerequisite: Speech and Drama 441. 2 credits.

457. Oral Interpretation
The analysis of literature as a basis for performance; demonstration and experimentation with methods of performance which will enhance particular pieces of literature; the development of a critical standard for evaluation of performance and, consequently, of literature. 2 lectures; 2 laboratories; 4 credits.

459. (459). Scenic Arts I (Stagecraft)
Technical aspects of theatrical production. Stage and television scenery construction and painting. Properties, sound, and backstage organization. Survey of costumes and lighting. Practical application in University Theater production. 4 credits.

475. (475). Stage Make-up
Fundamentals of juvenile, old age, character and special stage make-up techniques. Permission of instructor required. Laboratory fee: $10. 2 credits.

481. Summer Repertory Theater Workshop
An intensive workshop which includes the following: 1) Classes in voice, movement, make-up, and improvisation taught by the directors and professional actors of the resident company, 2) Experience in technical aspects of theater—scenery, costumes, lighting, publicity, 3) Performance in Summer Theater production with experienced resident actors. Admission to workshop by audition only. Enrollment by permission. Offered in the eight-week summer session. Classes, rehearsals, and performances to be arranged. 8 credits.
541. Theater Publicity
Public relations and publicity with relation to developing an audience for theatrical productions. Practical application to University Theater and other assigned productions. Suggested background: Speech and Drama 435. Permission of instructor. 2 credits.

542. Box Office and House Management
The business of Theater; box office procedure, house management and ancillary problems. Practical application to University Theater and other assigned productions. Suggested background: Speech and Drama 435, permission of instructor. 2 credits.

547. (547). Scenic Arts II (Stage Costume Design and Execution)
A full-year course covering costume history, styles, design theory, pattern-making, and construction. Students enrolling for lecture in either semester must be able to complete time-arranged requirements (practice) during the semester immediately following. Permission of instructor. 4 credits.

549. (549). Scenic Arts III (Stage Lighting Design and Practice)
A full-year course covering elementary electricity, design theory, instrumentation, control, and practice. Students enrolling for lecture in either semester must be able to complete time-arranged requirements during the semester immediately following. Permission of instructor. 4 credits.

551. Rehearsal and Performance I (Improvisation)
Development of fundamental vocal and physical stage techniques for actors and directors through exercises, improvisations, and theater games. Should be taken concurrently with Speech and Drama 441. 2 credits.

552. Rehearsal and Performance II (Characterization)
Application of prior training in Speech and Drama 551 (prerequisite) to building characterizations in scenes and short plays. Should be taken concurrently with Speech and Drama 442. 2 credits.

565. Musical Comedy Workshop
An introduction to musical comedy styles with an emphasis on improving audition and performance techniques. Students must be prepared with a song and sheet music on the first day of class. 4 credits.

575. Scenic Arts IV (Fundamentals of Scene Design)
Stage drafting, modules, materials, design theory, and styles. Individualized exercises and final project. Required for all theater majors. Prerequisite: Speech and Drama 459. Recommended: Speech and Drama 547, Speech and Drama 549. 4 credits.

620. Education through Dramatization
The exploration of the possibilities of learning through the use of puppetry, story-telling, involvement theater, creative dramatics, and theater for children and the application to the classroom, playground, recreation center, library hospital ward, etc. 4 credits.

621. Creative Dramatics
A study of creative dramatics as a teaching device with an emphasis on developing the student's confidence in the art of pantomime, improvisation, and story telling. Students are expected to work with the Durham Drama for Youth program. Prerequisite: Speech and Drama 620. 4 credits.
Speech and Drama

623. Theater for Children—Puppetry
A course based on all materials necessary for a successful children's production with an added emphasis on puppetry. (Alternate years with Speech and Drama 621). 4 credits.

624. Theater and Musical Production for Children
A production oriented course emphasizing children's musical performances and Story Theater techniques. (Alternate years with Speech and Drama 623.) 4 credits.

629. Community Oriented Children's Drama Programs
The student will work in a community developing new drama programs geared toward a child audience. 4 credits.

641. Play Analysis for Production
Analysis and discussion of a number of playscripts toward the end of developing coherent and meaningful production concepts for actors, technicians, directors, designers, teachers, etc. Prerequisites: Speech and Drama 435, 436 or 438 and either 459, or 551 and 552. (Alternate years with Speech and Drama 693.) 4 credits.

652. Scenic Arts V (Production Design)
Advanced exercises in all scenic arts toward full production plans, detail drawings, schedules, etc., for a hypothetical theater of the student's own design. Prerequisite: Speech and Drama 459, 547, and 549. 4 credits.

654 (654). Performance Project
Application of acting and directing theory to specific assigned responsibilities in a University Theater production or to an individual performance project. Prerequisites: Speech and Drama 551, 552. To be taken in conjunction with Speech and Drama 655, but not concurrently. 2 credits. (Can be repeated to 4 credits.)

655 (655). Scenic Art Project
Application of experience in design and technical aspects of theater to specific assigned responsibilities in a University Theater production or to an individual project or presentation. Prerequisites: Speech and Drama 459, 652. To be taken in conjunction with Speech and Drama 654, but not concurrently. 2 credits. (Can be repeated to 4 credits.)

657. Rehearsal and Performance III (Directing)
Continuation of Speech and Drama 552 (prerequisite). The director and performer develop interaction of character. Ensemble playing. Full directing responsibility for a one-act play. 4 credits.

658. Rehearsal and Performance IV (Styles)
Continuation of Speech and Drama 657 and of the sequence begun in Speech and Drama 551 and 552. Styles of drama for the actor and director: Greek, Shakespearean, eighteenth-century comedy and nineteenth-century realism. Prerequisites: Speech and Drama 551 and 552, 657, or the equivalent. 4 credits.

668. Group Interpretation
Choric speaking, reader's theater, chamber theater, and other forms of group interpretation in theory and practice. Prerequisite: Speech and Drama 457. 4 credits. (Alternate years.)

693. Theater Management
Theater organization, public relations, business, and box-office management with projects associated with University Theater activities. Special topics may be
explore by the individual. Prerequisite: four courses in theater. 4 credits. (Alternate years.)

750. (750). Writing for Performance
The study and application of principles of writing primarily for performance. Work done will include playwriting, writing for radio and television, writing for film. Emphasis will vary depending on the semester. Focus on original work with possible performances in other classes. May be taken three times for credit. Prerequisite: permission of instructor. 4 credits.

781. Theater Workshop for Teachers
This is an intensive seminar-workshop for teachers in rehearsal techniques, theater production, and stage direction, including work in laboratory and in summer repertory theater production as applicable to secondary-school theater. Offered in the summer session. To be arranged (classes, rehearsals, and performances.) 4 credits.

782. Theater Workshop for Teachers
The second half of Speech and Drama 781. Speech and Drama 781 is not a prerequisite for 782. Offered in the summer session. Classes, rehearsals, and performances to be arranged. 4 credits.

General

691. Laboratory or Field Experience
Emphasis to be selected. Taken in the senior year. 4 credits.

697. Senior Seminar I
Divisional and overall meetings as specifically planned each semester. Preparation for specific senior project combined with an overview of recent developments and trends in the oral-communication arts and sciences. Prerequisite: senior standing. 2 credits.

698. Senior Seminar II
The further development and completion of the senior project. Prerequisite: senior standing. 2 credits.

795, 796. Independent Study
Application of the theory of specific speech communication areas in individual or group projects. May be repeated and taken for variable credits of 2, 4, 6, or 8. Could be combined with the senior experience (for majors) for a total of 12 credits in the same semester if the student wished to be free to study off-campus. Project is to be developed with supervising instructor.

Technology (45)
Dean: Richard S. Davis

Technology courses, not readily identified with any one discipline and elective for students both within and out of the College of Technology, are listed here.

422. Introduction to Astronautics
Basic laws, principles, and operations of aeronautical and space systems for non-technical students. Emphasis on the concepts of the physical laws rather than in-depth mathematical rigor. Recommended for all levels of liberal arts students. Given to AFROTC students as Air Force 636. 4 credits.
Technology

501. Light: Sources and Uses
History of lighting from Edison's first lamp to the laser; production, transmission, and utilization of light; color, the spectrum, and the human eye; sources of light; controlling light; the four factors of seeing; designing a lighting installation. Applications of lighting in schools, offices, factories, stores, the home; for sports and recreation, agriculture, and medicine; in the ocean; and in public buildings. Open for credit to non-engineering students only. No math prerequisite, other than high school mathematics. 1 two-hour lecture; 1 two-hour group discussion; 4 credits.

555. How Electrical Things Work
An elective survey course designed for the completely uninitiated student. The qualitative understanding of the electrical, magnetic, and mechanical principles of commonly encountered technology in the household and automobile, to the level of elementary diagnosis and repair. At the end of the course each student will be able to diagnose and repair simple household electrical problems in wiring and small appliances, and simple automotive electrical problems in the ignition system (tune-up), the generation system, and the starting system. The course will consist of laboratory-discussions in which the principles of typical equipment will be explained, measured while in operation, and disassembled to show the principles of design, diagnosis, and repair. Student interest will influence the topics considered. Open for credit to non-College of Technology students only. 2 two-hour lecture-demonstrations; laboratory-demonstrations; 4 credits.

601. Statistical Methods in Engineering and Physical Science
Methods of organizing data and statistical techniques for data analysis as applied to problems in engineering and physical science. Elementary probability theory, probability distributions, tests of significance, correlation, and regression analysis. Design of experiments; completely randomized blocks; factorials, fractional factorials; process optimization. Introduction to quality control; construction and analysis of control charts for variables and attributes; statistical aspects of tolerance. 4 credits.

610. Introduction to Ocean Engineering
This course will be conducted on a seminar basis. It will deal with engineering problems arising in various fields of current oceanographic interest. Typical areas will be marine biology, saturation diving systems, and physical oceanography. In addition to the engineering faculty directing this course, other experts in the fields of ocean science and engineering will be invited to participate. Prerequisite: Permission of instructor. 4 credits.

683. Technology: Its Role and Function in Society
A study of the impact of Technology on social systems, with examination of both current and historical examples. Consideration of interrelations between social customs, psychological responses, physical needs, and technological developments. Examination of the decision-making process involved with technological change and the interrelationship between technology and public policy. Instruction is given by lectures, group discussions, interviews with key people, and through extensive reading assignments. Prerequisite: junior and senior standing and permission of instructor. 2 2-hour lecture or discussion periods per week; 4 credits.
Wildlife Management  
(See Institute of Natural and Environmental Resources)

Zoology (84)  
Chairman: Philip J. Sawyer

PROFESSORS: Edythe T. Richardson, emerita; Wilbur L. Bullock, Lorus J. Milne, Philip J. Sawyer, Emery F. Swan, Paul A. Wright

ASSOCIATE PROFESSORS: Paul E. Schaefer, emeritus; Arthur C. Borror, Robert A. Croker, Frank K. Hoornbeek, Marcel E. Lavoie, John J. Sasner, Edward K. Tillinghast


(412), 412. Principles of Zoology  
Concepts of animal biology, including an introduction to ecological relationships, anatomy, physiology, embryology, taxonomy, and evolution. Intended principally for majors in the biological sciences. 4 credits.

507-508. Human Anatomy and Physiology  
An integrated presentation, by systems, of structure and function in the human body. Lectures are strongly oriented toward physiology. Weekly laboratories alternate between dissection of a preserved small mammal and physiological exercises, involving observations on living tissues. 4 credits.

(518). Vertebrate Morphology  
A study of the basic morphological features of the vertebrates. The structure of the major systems will be studied at both the macroscopic and microscopic levels. Prerequisite: Zoology 412. 4 credits.

527. Vertebrate Physiology  
Designed to complement Zoology 518 in comparing the functioning of vertebrate organ systems. Prerequisite: Zoology 412, 518. 4 credits.

542. Ornithology  
Birds, their identification, migration, life histories, and economic importance, with special reference to those of eastern North America. Prerequisite: one semester of biology. 4 credits.

604. Principles of Genetics  
An introduction to the chemical and physical basis of inheritance; genes and chromosomes as units of mutation, structure, and function; organization of the genetic material; genes in populations. Students desiring formal laboratory experience should register in Zoology 706. Prerequisite: Zoology 412 or equivalent and junior standing. 4 credits.

618. Introductory Invertebrate Zoology  
A lecture and laboratory survey of the invertebrate phyla with emphasis on their systematics, morphology, phylogeny, and natural history. Prerequisite: Zoology 412 or equivalent. 4 credits.

(700). Research Concepts and Methods  
A workshop introduction to the process of biological investigation. Includes presentations of current research by members of the Zoology faculty; critical discussions of the philosophy and history of biological science; methods and
practice in literature-search and the handling of bibliographic data; lectures and laboratories in scientific writing. Each student will prepare both written and oral presentations of a review of a selected biological topic. Required of all beginning zoology graduate students. Prerequisite: permission of instructor. 4 credits.

703. General and Comparative Genetics
Comparative analysis of genetic systems with emphasis given to diploids and the role of gene and chromosome mutations in their evolution. Evolution of dominance and sex determination. Consideration will also be given to techniques useful in statistical and experimental approaches to analyses of diploid inheritance. Prerequisite: Zoology 604 or equivalent. 4 credits. (Alternate years.)

704. Comparative Endocrinology
The various endocrine organs are considered in their relationship to control of the internal environment, growth, development, and adaptation to the external environment. Prerequisite: vertebrate anatomy and physiology; organic chemistry. 4 credits.

706. Genetics Laboratory
Experiments and demonstrations in classical, developmental, and population genetics and cytogenetics, utilizing a wide range of organisms and techniques. Prerequisite or concurrent: Zoology 604 or equivalent and permission of instructor. 2 credits.

711. Natural History of Cold-Blooded Vertebrates
The various classes of poikilothermic vertebrates—their habits, habitats, and life histories—with special reference to those occurring in eastern North America. Prerequisite: general zoology and Zoology 518. 4 credits.

(712). Mammalogy
The origin and diversification of mammals, their reproductions, ecology, behavior, and economic importance. Laboratories will emphasize techniques of the mammalogist and identification of local forms. Prerequisite: general zoology and Zoology 518. 4 credits.

(713). Animal Behavior
Individual and group behavior of animals, including the role of anatomy, physiology, and prior experience, and the ecological significance of these behavioral mechanisms. Techniques and the practical application of the study of animal behavior. Prerequisite: one year of zoology. 4 credits.

715. Natural History of Marine Invertebrates
A field and laboratory course designed to acquaint the student with the inshore marine invertebrate metazoan animals of northern New England. Emphasis will be on identification, classification, habitat preferences, and behavior of these animals. Field work (collection and observation) will constitute a major part of the course and the student must be prepared to assume some travel expense. Prerequisite: general zoology. Summer only. 4 credits.

721. Parasitology
An introductory course on some of the more important parasites causing disease in man and animals. Living materials will be used as far as possible. Prerequisite: one year of zoology. 4 credits.

723. Cell Physiology
Application of the principles of chemistry and physics to the understanding of cell structure and function. Metabolic reactions and their control are considered
in relation to cell organization. Treatment is also given to the genesis and function of specialized cells. Prerequisite: organic chemistry. 4 credits.

724. Marine Parasitology
A study of the diseases and parasites of marine fishes and shellfish with particular reference to the local estuarine environment. Prerequisites: Zoology 508 or 518 or equivalent and a course in invertebrate zoology. 4 credits.

726. General Physiology
A study of some of the physical and chemical phenomena common to all biological systems. Special emphasis is placed on membranes, permeability, excitability, conductivity, contractility, and bioenergetics. Prerequisites: organic chemistry, physics, and one year of zoology. 4 credits.

729. Vertebrate Embryology
The fundamental principles of vertebrate growth and development, including metamorphosis, regeneration and aging, as well as embryonic development. Prerequisites: Zoology 518, 527 and 604 or equivalent. 4 credits.

730. Histology and Microtechnic
The microscopic anatomy of tissues and organs of vertebrates and an introduction to routine techniques used in such studies. Prerequisite: Zoology 508 or 518 or equivalent. 1-hour lecture; 6-hours laboratory; 4 credits.

772. Fisheries Biology
Designed to introduce the student to some of the information and techniques used by the freshwater fisheries biologist. Emphasis on freshwater fisheries, but many of the techniques and some of the readings pertain as well to salt water fisheries. Prerequisite: Zoology 711 or equivalent, and permission of instructor. 4 credits.

774. Introduction to Marine Science
Daily lectures, laboratory and field work. Offered at the Isles of Shoals in cooperation with Cornell and the State University of New York. Summers only. Prerequisite: at least a full year of college biology. 4 credits.

795, 796. Special Problems in Zoology
Faculty and Professional Staff

Faculty Emeritis

Abbot, Helen D.  
Associate Professor Emeritus, Library  

Babcock, Donald C.  
Professor Emeritus of Philosophy  
B.A., University of Minnesota, 1907; M.A., ibid., 1908; S.T.B., Boston University, 1912; D.H.L. (Hon.), University of New Hampshire, 1960. (1918 to 1956)

Barraclough, Kenneth E.  
Professor Emeritus of Forestry,  
Extension Forester Emeritus  
B.A., New York State College of Forestry, Syracuse University, 1921; M.F., Harvard University, 1940. (1926 to 1963)

Bartley, Irving D.  
Associate Professor Emeritus of Music and University Carillonneur  
B.M., Syracuse University, 1935; M.M., ibid., 1938. (1945 to 1968)

Barton, Philip S.  
Director Emeritus, Thompson School of Applied Science, and Professor Emeritus of Applied Animal Science  
B.S., University of New Hampshire, 1928; M.Ed., ibid., 1938. (1939 to 1969)

Bingham, Sylvester H.  
Professor Emeritus of English  
A.B., Dartmouth College, 1922; A.M., Harvard University, 1929; Ph.D., Yale University, 1937. (1936 to 1970)

Bowles, Ella S.  
Publications Editor Emeritus  
Plymouth Normal School, 1905. (1943 to 1951)

Boynton, C. Hilton  
Professor Emeritus of Dairy Science and Extension Dairyman Emeritus  
B.S., Iowa State College, 1934; M.S., ibid., 1940; Ph.D., Rutgers University, 1962. (1945 to 1972)

Brackett, Thelma  
University Librarian Emeritus  
A.B., University of California, 1919; Certificate, California State Library School, 1920; D.H.L. (Hon.), University of New Hampshire, 1962. (1942 to 1962)

Bratton, Karl H.  
Professor Emeritus of Music  
B.M., University of Kansas, 1931; M.A., Teachers College, Columbia University, 1945. (1945 to 1971)

Campbell, Willis C.  
Research Associate Emeritus,  
Engineering Experiment Station  
B.S., New Hampshire College, 1906. (1938 to 1954)

Carroll, Herbert A.  
Professor Emeritus of Psychology  
A.B., Bates College, 1923; A.M., Brown University, 1928; Ph.D., Columbia University, 1930. (1941 to 1962)

Colby, Halstead N.  
Associate Professor Emeritus of Soil and Water Science, Extension Agricultural Engineer Emeritus  
B.S., University of New Hampshire, 1930. (1932 to 1936, 1946 to 1968)
Colovos, Nicholas F.  
Professor Emeritus of Animal Science  
B.S., University of New Hampshire, 1927;  
M.S., ibid., 1931. (1928 to 1971)

Conklin, James G.  
Professor Emeritus of Entomology  
B.S., Connecticut Agricultural College, 1926;  
M.S., University of New Hampshire, 1929;  
Ph.D., Ohio State University, 1941.  
(1931 to 1971)

Cortez, Edmund A.  
Professor Emeritus of Speech  
B.A., Taylor University, 1923; B.O., Asbury College, 1924; B.D., Asbury Theological Seminary, 1924; M.A., Columbia University, 1926; Ed.M., Harvard University, 1927.  
(1927 to 1965)

Danoff, Alexander P.  
Assistant Professor Emeritus of German  

DeQuoy, Ruth W.  
Associate State 4-H Leader Emeritus  
B.A., New Hampshire College, 1921;  
M.Ed., University of Maryland, 1953.  
(1929 to 1965)

Donovan, Edward T.  
Professor Emeritus of Mechanical Engineering  
B.S., University of Wisconsin, 1921.  
(1926 to 1968)

Dunn, Stuart  
Professor Emeritus of Botany  
B.S., University of Minnesota, 1923; M.S.,  
Iowa State College, 1925; Ph.D., University  
of Minnesota, 1931. (1926 to 1970)

Eggert, Russell  
Professor Emeritus of Horticulture  
B.S., Michigan State College, 1929; M.S.,  
ibid., 1939. (1942 to 1946, 1948 to 1970)

Ellis, Elizabeth E.  
Extension Associate Professor Emeritus  
of Home Economics  
B.S., Teachers College, Columbia University, 1927; M.A., ibid., 1929. (1929 to 1960)

Hall, Harry H.  
Professor Emeritus of Physics  
B.S., Union College, 1926; Ph.D., Harvard  
University, 1934. (1940 to 1969)

Haslerud, George M.  
Professor Emeritus of Psychology  
B.A., University of Minnesota, 1930; Ph.D.,  
ibid., 1934. (1945 to 1972)

Hennessy, William G.  
Professor Emeritus of English  
A.B., Boston University, 1916; A.M., ibid.,  
1924; D.F.A. (Hon.), Transylvania College,  
1966; Litt.D. (Hon), University of New  
 Hampshire, 1967. (1923 to 1961)

Higgins, Leroy J.  
Associate Professor Emeritus of Agronomy  
B.S., University of New Hampshire, 1923.  
(1927 to 1928, 1929 to 1970)

Hitchcock, Leon W.  
Professor Emeritus of Electrical Engineering  
B.S., Worcester Polytechnic Institute,  
1908. (1910 to 1956)

Hoitt, Samuel W.  
Director Emeritus of the Cooperative Extension Service and Professor of Agricultural Education  
B.S., University of New Hampshire, 1928;  
M.S., ibid., 1931. (1929 to 1970)

Holden, John T.  
Professor Emeritus of Political Science  
A.B., Wesleyan University, 1936; M.P.A.,  
Harvard University, 1941; M.A., ibid.,  
1942; Ph.D., ibid., 1943; LL.D., (Hon.),  
Nasson College, 1958. (1947 to 1972)

Huddleston, Eric T.  
Professor Emeritus of Architecture  
B.Arch., Cornell University, 1910. (1914  
to 1957)

Iddles, Harold A.  
Professor Emeritus of Chemistry  
B.S., Michigan State College, 1918; M.S.,  
University of Iowa, 1921; Ph.D., Columbia  
 University, 1925; D.Sc. (Hon.), University  
of New Hampshire, 1966. (1929 to 1965)
Johnson, Arthur W.
Professor Emeritus of Business and Economics
B.B.A., College of Business Administration, Boston University, 1922; M.B.A., ibid., 1929; C.P.A., (1920 to 1963)

Johnson, G. Reid
Associate Professor Emeritus of History
A.B., Muskingum College, 1916; M.A., Princeton University, 1920; Ph.D., University of Edinburgh, 1922. (1932 to 1963)

Lavine, Irvin
Professor Emeritus of Chemical Engineering
B.S., University of Minnesota, 1924; Ph.D., ibid., 1930. (1948 to 1949, 1951 to 1965)

Maynard, Max S.
Professor Emeritus of English
B.A., University of British Columbia, 1937. (1946 to 1972)

Mills, Marian E.
Assistant Professor Emeritus of Botany
B.S., Teachers College, Columbia University, 1917; M.A., ibid., 1920. (1927 to 1957)

Moore, Herbert C.
Associate Professor Emeritus of Dairy Science
B.S., Purdue University, 1923; M.S., University of Minnesota, 1925. (1928 to 1970)

Morrow, Kenneth S.
Professor Emeritus of Dairy Science
B.S., University of Minnesota, 1918; M.S., ibid., 1925. (1934 to 1966)

Nast, Charlotte G.
Professor Emeritus of Botany
B.A., University of Wisconsin, 1927; M.A., ibid., 1929; Ph.D., University of California, 1938. (1948 to 1970)

O’Kane, Walter C.
Professor Emeritus of Economic Entomology
B.A., Ohio State University, 1897; M.A., ibid., 1909; D.Sc. (Hon.), ibid., 1932. (1909 to 1947)

Partridge, Allan B.
Associate Professor Emeritus of History
A.B., Clark University, 1922; A.M., ibid., 1923. (1925 to 1971)

Perry, Errol C.
Thompson School Assistant Professor Emeritus of Farm Management
B.S., Massachusetts State College, 1920. (1929 to 1942, 1946 to 1962)

Phillips, Thomas G.
Professor Emeritus of Agricultural and Biological Chemistry
B.S., Ohio State University, 1912; M.S., ibid., 1913; Ph.D., University of Chicago, 1918. (1925 to 1957)

Prince, Ford S.
Professor Emeritus of Agronomy
B.S., University of Illinois, 1913. (1925 to 1957)

Richardson, Edythe T.
Professor Emeritus of Zoology
B.S., New Hampshire College, 1922; M.S., University of New Hampshire, 1924. (1922 to 1966)

Sackett, Everett B.
Dean Emeritus of the College of Liberal Arts and Professor Emeritus of Education
B.A., Hamline University, 1923; M.A., University of Minnesota, 1926; Ph.D., Columbia University, 1931. (1938 to 1967)

Schaefer, Paul E.
Associate Professor Emeritus of Zoology
A.B., Bethany College, 1926; M.S., Ohio State University, 1931; Ph.D., ibid., 1936. (1941 to 1971)

Seiberlich, Joseph
Research Professor Emeritus, Engineering Experiment Station
Diploma Ingenieur, Technical University, Karlsruhe, Germany, 1924; Doctor Ingenieur, ibid., 1928. (1941 to 1962)

Shiner, Stanley R.
Professor Emeritus of Biochemistry
B.S., Muhlenberg College, 1918; M.S., Pennsylvania State College, 1923. (1924 to 1966)
Skelton, Russell R.
Professor Emeritus of Civil Engineering
B.S., Purdue University, 1924; c.e., ibid., 1934; S.M., Harvard University, 1939.
(1928 to 1966)

Stevens, Clark L.
Professor Emeritus of Forestry
B.S., New Hampshire College, 1917; M.F., Yale University, 1926; Ph.D., ibid., 1930.
(1919 to 1964)

Stevens, Henry B.
Director Emeritus of University Extension Service
A.B., Dartmouth College, 1912. (1918 to 1956)

Stolworthy, E. Howard
Professor Emeritus of Mechanical Engineering
B.S., Tufts College, 1922. (1922 to 1968)

Swasey, Henry C.
Associate Professor Emeritus of Intercollegiate Athletics
B.S., Amherst College, 1915; M.S., Indiana University, 1941. (1921 to 1962)

Sweet, Paul C.
Coach of Track and Cross Country and Professor Emeritus of Physical Education
B.S., University of Illinois, 1923; M.S., University of Southern California, 1941.
(1924 to 1970)

Thames, Sarah
Associate Professor Emeritus of Home Economics
B.S., Simmons College, 1930; M.A., Teachers College, Columbia University 1942. (1945 to 1961)

Tirrell, Loring V.
Professor Emeritus of Animal Science
B.S., Massachusetts Agricultural College, 1920; M.S., Massachusetts State College, 1941. (1921 to 1925, 1930 to 1966)

Tyrrell, Doris E.
Associate Professor Emeritus of Secretarial Studies
B.S., University of Minnesota, 1926; M.A., ibid., 1932. (1938 to 1966)

Walsh, John S.
Professor Emeritus of Languages
A.B., Harvard University, 1915; A.M., Boston University, 1928; D.H.L. (Hon), University of New Hampshire, 1965. (1922 to 1962)

Warren, Richard
Professor Emeritus of Poultry Science, Extension Poultyman Emeritus
B.S., Cornell University, 1934; M.S., ibid., 1935. (1937 to 1970)

Webster, Robert G.
Professor Emeritus of English

Woodruff, Ruth J.
Professor Emeritus of Economics
B.A., Bryn Mawr, 1919; A.M., ibid., 1920; Ph.D., Radcliffe College, 1931. (1931 to 1967)

Wooster, Caroline S.
Associate Professor Emeritus of Physical Education
Cert., Sargent School for Physical Education, 1926; B.S., University of New Hampshire, 1934. (1944 to 1970)

Yale, William
Professor Emeritus of History
Ph.D., Sheffield Scientific School, Yale University, 1910; M.A., University of New Hampshire, 1928. (1928 to 1957)

Zimmerman, Oswald T.
Professor Emeritus of Chemical Engineering
B.S.E., University of Michigan, 1929; M.S.E., ibid., 1931; Ph.D., ibid., 1934. (1938 to 1970)

Faculty

Abbot, Elinor
Instructor in Anthropology

Abeles, Sigmund M.
Associate Professor of The Arts

* Indicates time devoted to Cooperative Extension Service.
† Indicates time devoted to Agricultural Experiment Station.
Abromson, Morton C.
Instructor in The Arts

Ackerman, Margaret D.
Assistant Professor of Education

Adamovich, Frank W.
Assistant Professor, Documents Librarian

Adams, Robert L.
Assistant Professor of Geography

Albers, Carl H.
Adjunct Professor of the Whittemore School

Aldrich, Terry Lee
Head Ski Coach and Lecturer in Physical Education
B.S., St. Lawrence University, 1968. Appointed 1972.

†Allen, Fred E.
Professor of Animal Science and Veterinarian
B.S., University of New Hampshire, 1932; B.V.M., Ohio State University, 1936. Appointed 1940.

Allen, Richard
Associate Professor of Hospital Administration, Whittemore School

Allmendinger, Eugene
Associate Professor of Mechanical Engineering

Alonzo, Roy S.
Thompson School Assistant Professor of Food Service Management

Alperi, Robert W.
Assistant Professor of Mechanical Engineering

Amell, Alexander R.
Professor of Chemistry
B.S., University of Massachusetts, 1947; Ph.D., University of Wisconsin, 1950. Appointed 1955.

Amman, William
Lecturer in Occupational Therapy
M.R.C.S., L.R.C.P., University College Hospital, 1937; Diploma of Public Health, University of Cape Town, 1944; L.M.C.C., Canada, 1950. Appointed 1965.

Amsden, Katherine
Associate Professor of Physical Education

Andersen, Kenneth K.
Professor of Chemistry
B.S., Rutgers University, 1953; Ph.D., University of Minnesota, 1959. Appointed 1960.

Anderson, Charlotte K.
Professor, Assistant Librarian

Anderson, Franz E.
Associate Professor of Geology
Andrew, Michael D.  
*Associate Professor of Education  

Andrews, Richard A.  
*Professor of Resource Economics  
B.S., University of Maine, 1949; M.S., Pennsylvania State University, 1951; Ph.D., University of Minnesota, 1959. Appointed 1959.

Annis, William H.  
*Associate Professor of Occupational Education  

Antosiewicz, Rose T.  
*Assistant Professor of Italian  

Arnoldy, Roger L.  
*Associate Professor of Physics  

Ashley, Charles H.  
*Assistant Professor of Education and Coordinator of Secondary School Student Teaching  

Aultman, Dwight E., III  
*Trainer, Physical Therapist; Assistant Professor of Physical Education  

Azzi, Victor D.  
*Professor of Mechanics  

Baker, Alan L.  
*Instructor in Botany  

Balderacchi, Arthur E.  
*Associate Professor of The Arts  

Balling, L. C.  
*Associate Professor of Physics  

Balomenos, Richard H.  
*Professor of Mathematics Education  

Bangs, Judith M.  
*Instructor in Philosophy  

Banks, Russell E.  
*Lecturer in English  

Bardwell, John D.  
*Director, Division of Media Services and Associate Professor of Education  

Barlow, Robert F.  
*Professor of Economics and Business Administration  

*Barrett, James P.  
*Associate Professor of Forest Biometrics  

Barstow, Thomas R.  
*Assistant Professor of Physical Education  
Bartley, Clara H.
Research Associate in Microbiology
B.S., Miami University, 1923; M.A., University of Michigan, 1926; Ph.D., University of Kansas, 1935. Appointed 1945.

Batchelder, Gerald M.
Thompson School Associate Professor of Civil Technology and Adjunct Associate Professor of Civil Engineering
B.S., University of New Hampshire, 1950; M.S.C.E., Purdue University, 1952. Appointed 1953.

Batcheller, Joseph D.
Professor of Speech and Drama

Batho, Edward H.
Professor of Mathematics

Beasley, Wayne M.
Associate Professor of Materials Science

Beckett, Homer F., Jr.
Associate Professor of Mathematics

Bennett, Albert B.
Associate Professor of Mathematics

Bermier, Raymond J.
Assistant Professor and Technical Director of Speech and Drama

Bertsch, Gregory J.
Assistant Professor of Psychology

Betz, George W.
Associate Professor of Economic Development

Bianco, David P.
Director of Residences

Bigelow, Nancy Charity
Lecturer in Medical Technology

Bigglestone, Gail A.
Assistant Professor of Physical Education

Biggs, May K.
Assistant Professor of Botany

Birch, Francis S.
Assistant Professor of Earth Sciences
Birmingham, Frank P.
Assistant Professor of Philosophy
B.A., University of Kansas, 1963; M.A., University of Michigan, 1966; Ph.D., University of Michigan, 1972.
Appointed 1968.

Bishop, Paul L.
Assistant Professor of Civil Engineering
B.S.C.E., Northeastern University, 1968; M.S.C.E., Purdue University, 1970; Ph.D., ibid., 1972. Appointed 1971.

Blanchard, Fletcher A., Jr.
Professor of Electrical Engineering

Blanchard, Robert O.
Assistant Professor of Plant Pathology

Blaschak, Veronica Macrina
Assistant Professor of Education

†Blickle, Robert L.
Professor of Entomology
B.S., Ohio State University, 1937; M.S., University of New Hampshire, 1939; Ph.D., Ohio State University, 1942. Appointed 1938-1941, 1946.

Bobick, Melvin T.
Associate Professor of Sociology

Boehme, Linda
Assistant Professor of Home Economics

Bogle, Alfred Linn
Assistant Professor of Botany

Bolian, Charles
Instructor in Anthropology

Bonner, Thomas N.
President of the University and Professor of History

Bonneice, William E.
Associate Professor of Mathematics

Borror, Arthur C.
Associate Professor of Zoology

Bothner, Wallace A.
Assistant Professor of Geology

Bovino, J. Patrick
Instructor in Business Administration

Bowen, Diane V.
Lecturer in Medical Technology

Bowers, Dolores J.
Assistant Professor of Nursing

Bowes, M. William
Head Football Coach and Lecturer in Physical Education

Bowman, James S.
Assistant Professor of Entomology and Extension Entomologist
B.S.C., Ohio State University, 1951; M.Sc., ibid., 1954; Ph.D., University of Wisconsin, 1958. Appointed 1971.
Bowring, James R.
Professor of Resource Economics
B.S.A., University of Manitoba, 1936; M.A.,
University of Alberta, 1941; Ph.D., Iowa
State University, 1944. Appointed 1948.

Boy, Angelo V.
Professor of Education
A.B., University of Notre Dame, 1953;
Ed.D., Boston University, 1955; Ed.D.,

Boynton, Jason E.
Associate Professor of Education
B.Ed., Plymouth Teacher's College, 1949;
M.Ed., University of New Hampshire.

Bozk, John C., Jr.
Thompson School Associate Professor of
Forest Technology
B.S., University of Connecticut, 1962;
M.F., Yale School of Forestry, 1963.
Appointed 1967.

Brall, Allan J.
Associate Professor of Economics and
Business Administration
A.B., University of Rochester, 1951;
M.B.A., Columbia University, 1953; Ph.D.,
University of Wisconsin, 1959.
Appointed 1965.

Bravo, Donald
Lecturer in Music
B.M., New England Conservatory of
Music, 1956; M.M., Boston Conservatory of

Breeding, Charles H. J.
Thompson School Associate Professor of
Applied Soil Sciences
B.S., University of New Hampshire, 1949;

Briden, Earl F.
Assistant Professor of English
Ed.D., Rhode Island College, 1963; M.A.,
Brown University, 1966; Ph.D., Ibid.,

Briggs, Janet C.
Lecturer in Animal Science
B.S., University of Massachusetts, 1962.
Appointed 1963.

Brinsfield, Shirley D.
Adjunct Professor of the Whittemore
School
B.A., University of Washington, 1949;
Appointed 1968.

Broekelman, Paul T.
Associate Professor of Philosophy
A.B., Dartmouth College, 1957; M.A.,
Northwestern University, 1963; Ph.D.,

Brown, Warren R.
Instructor in Political Science
B.A., Willamette University, 1966; M.A.,
Claremont Graduate School, 1972.
Appointed 1972.

Brown, Evelyn
Professor of Physical Education
A.B., University of California, 1943; M.A.,
Teachers College, Columbia University,
1943; M.A., University of New Hamp-

Bruns, Paul E.
Professor of Forest Resources
A.B., New York University, 1937; M.F.,
Yale University, 1940; Ph.D., University

Bryce, Forbes O.
Lecturer in Sociology and Anthropology
B.S., Massachusetts Maritime Academy,
1936; M.A., University of New Hampshire,

Bucci, Frank A.
Assistant Professor of Hotel
Administration
B.S., University of New Hampshire, 1949;
Appointed 1970.

Buckley, Walter
Professor of Sociology
B.A., Brown University, 1952; Ph.D., Uni-
versity of Wisconsin, 1958.
Appointed 1971.

Bullock, Wilbur L.
Professor of Zoology
B.S., Queens College, 1942; M.S., Uni-
versity of Illinois, 1947; Ph.D., Ibid.,
Bunker, Laurel G.
Assistant Professor of Occupational Therapy, Supervisor, Clinical Affiliation Program
b.s., Tufts College, 1951; m.a., California State College at Los Angeles, 1967. Appointed 1968.

Burns, Thomas R.
Assistant Professor of Sociology

Burrows, Julia M. L.
Instructor in Occupational Therapy

Burton, David M.
Associate Professor of Mathematics

Bush, David W.
Thompson School Instructor in Civil Technology

Byers, Gordon L.
Professor of Soil and Water Science
b.s., McGill University, 1948; m.s.a., Ontario Agricultural College, 1950. Appointed 1956.

Cahill, Vincent S., Jr. (Colonel, USAF)
Professor, Aerospace Studies

Caldon, Beverly J.
Lecturer in Music

Caldwell, S. Anthony
Assistant Professor of English
a.b., Columbia College, 1952; m.a., Columbia University, 1953; ph.d., Harvard University, 1968. Appointed 1957.

Callan, Richard J.
Associate Professor of Spanish

Canavan, Patrick
Visiting Instructor in Business Administration
b.b.a., Iona College, 1966; m.phil., Yale University, 1969. Appointed 1972.

Carbonneau, Lionel J.
Coach of Lacrosse and Assistant Professor of Physical Education

Cargill, Mary C.
Assistant Professor, Serials Cataloger

Carnicelli, Thomas A.
Associate Professor of English

Carter, Gavin H.
Associate Professor of Physical Education

Casás, R. Alberto
Professor of Spanish

Cavalcuci, Ralph J.
Assistant Football Coach and Lecturer in Physical Education
b.s., Utah State University, 1954; m.a., Columbia University, 1960. Appointed 1972.

Cavanaugh, John R.
Assistant Professor of Education and Assistant Dean, School of Continuing Studies
Celikkol, Barbaros
Visiting Assistant Professor of Mechanical Engineering
Appointed 1969.

Cerny, James W.
Lecturer in Geography
Appointed 1972.

Chabot, Brian F.
Assistant Professor of Botany
B.S., College of William and Mary, 1965; Ph.D., Duke University, 1971.
Appointed 1971.

Chaltas, John G.
Associate Professor of Education

Chapman, Donald H.
Professor of Geology
B.A., University of Michigan, 1927; M.A., ibid., 1928; Ph.D., ibid., 1931. Appointed 1931.

Chasteen, N. Dennis
Assistant Professor of Chemistry

Chen, Jiann-Jer
Thompson School Visiting Lecturer in Mathematics

Chesbro, William R.
Professor of Microbiology

Chupp, Edward L.
Professor of Physics

Cimbolic, Peter
Psychologist, Counseling and Testing Center and Adjunct Assistant Professor of Psychology

Clark, Charles E.
Associate Professor of History

Clark, David G.
Associate Professor of Physics

Clark, Ronald R.
Associate Professor of Electrical Engineering
B.S., University of New Hampshire, 1956; M.E., Yale University, 1957; Ph.D., Syracuse University, 1963. Appointed 1957.

Clark, William E.
Assistant Professor of Mechanical Engineering
B.S., University of New Hampshire, 1931. Appointed 1946.

Clarke, Susan
Instructor in Occupational Therapy

Clee, Jan E.
Dean of the Whittemore School of Business and Economics and Professor of Organizational Development

Cobb, Loren
Instructor in Sociology
Cohen, Allan R.  
Associate Professor of Business Administration  

Colbourn, H. Trevor  
Dean of the Graduate School and Professor of History  

Cole, Lawrence P.  
Assistant Professor of Economics and Assistant Dean of the Whittemore School of Business and Economics  

†Collins, Walter M.  
Professor of Animal Science  

Congdon, Robert G.  
Director of the Counseling and Testing Center and Associate Professor of Psychology  

Conner, Theodore W.  
Coach of Baseball and Assistant Professor of Physical Education  

Coolidge, Clyde R.  
Lecturer in Business Administration  

Copeland, Arthur H., Jr.  
Professor of Mathematics  

Copeland, Lynda P.  
Lecturer in Music  

Coppola, Joseph P.  
Assistant Football Coach and Lecturer in Physical Education  

†Corbett, Alan C.  
Associate Professor of Animal Science  

Corcoran, Ellen P.  
Instructor in Education  

Corell, Robert W.  
Professor of Mechanical Engineering  

Corsack, Howard  
Visiting Professor in Administration  

Course, Carol M.  
Instructor in Home Economics  

Craig, Robert E.  
Assistant Professor of Political Science  

Cramer, Eva B.  
Visiting Lecturer in Animal Science  
Croker, Robert A.  
Associate Professor of Zoology  

Crowson, Lydia L.  
Assistant Professor of French  

Curcio, Ronald P.  
Assistant Professor of Education  

Cushing, Daniel  
Honorary Fellow in Metallurgy  
Ph.D., Yale University, 1912. Appointed 1952.

Daggett, Albert F.  
Professor of Chemistry  
B.S., University of New Hampshire, 1928; M.S., ibid., 1930; Ph.D., Columbia University, 1934. Appointed 1928-31, 1935.

Darlington, Sidney  
Adjunct Professor of Electrical Engineering  
B.S., Harvard University, 1928; B.S., Massachusetts Institute of Technology, 1929; Ph.D., Columbia University, 1940. Appointed 1971.

Datilio, Louis J.  
Gymnastics Coach and Lecturer in Physical Education  

Dauphinais, Edward J.  
Associate Professor, Technology Branch Librarian  

Davenport, Gilbert B.  
Assistant Professor of Speech and Drama  

†Davis, Henry A.  
Associate Professor of Analytical Services  
B.S., University of New Hampshire, 1932; M.S., ibid., 1934. Appointed 1932.

Davis, James R.  
Assistant Professor of Psychology  

Davis, Myra L.  
Associate Professor of Secretarial Studies  
B.S., Central Missouri State Teachers College, 1939; M.A., State University of Iowa, 1945. Appointed 1945.

Davis, Richard S.  
Dean of the College of Technology and Professor of Materials Science  

Dawson, Carl  
Associate Professor of English  

Dawson, Charles O.  
Professor of Civil Engineering  
B.C.E., Ohio State University, 1930; M.S., ibid., 1940. Appointed 1930.

Dawson, John F.  
Assistant Professor of Physics  

Dawson, Judith A.  
Instructor of Home Economics  

Deane, Nancy H.  
Assistant Dean of the College of Liberal Arts and Lecturer in English  
Dee, Norman J.
Lecturer in Music

Degler, Carroll M.
Professor of Business Administration and Economics

Deichert, Lillian C.
Associate Professor, Loan Librarian

Deporte, Michael V.
Assistant Professor of English

Desrosiers, Richard V.
Assistant Professor of Classics

DeVoto, Mark B.
Assistant Professor of Music

deVries, Robbert P.
Lecturer in Music

Dewey, Richard S.
Professor of Sociology

Dickman, C. Meigs
Assistant Professor of Nursing

Diller, Karl C.
Associate Professor of English

Dishman, Robert B.
Professor of Political Science

Dodds, John A.
Thompson School Associate Professor of Applied Animal Science

Dodge, Peter
Associate Professor of Sociology

Dodrill, Isabel
Associate Professor of Home Economics
State Extension Home Economist

Doherty, Edward J.
Director of Career Planning and Placement

Dolcino, Luigi N.
Lecturer in Occupational Therapy

Donovan, John V.
Assistant Professor of Economics

Dotchir, L. William, Jr.
Instructor in Physics, Research Physicist, Space Science Center
Downs, Richard E.
Associate Professor of Anthropology
B.A., Harvard University, 1942; Cert. of Ethn., University of Paris, 1949; Ph.D., University of Leiden, 1956.
Appointed 1962.

Draves, David D.
Associate Professor of Education
B.A., University of Wisconsin, 1948; M.A., ibid., 1949; Ph.D., ibid., 1957.
Appointed 1964.

Drew, William H.
Associate Dean of the Graduate School, Coordinator of Research, and Professor of Resource Economics
B.S., Pennsylvania State College, 1947; M.S., Rutgers University, 1949; Ph.D., Vanderbilt University, 1961.
Appointed 1956.

Dunann, Deborah H.
Lecturer in Psychology
Appointed 1972.

Duncan, Lillian R.
Associate Professor, Public Service Librarian
B.A., University of Oklahoma, 1933.
Appointed 1934.

†Dunlop, William R.
Professor of Animal Science and Extension Poultry Pathologist

†Dunn, Gerald M.
Professor of Plant Science
B.S., West Virginia University, 1948; M.S., Purdue University, 1950; Ph.D., ibid., 1951. Appointed 1951.

Durgin, Owen B.
Associate Professor of Resource Economics

Durnall, Edward J.
Director of the Division of Continuing Education and Associate Professor of Education

Dusek, R. Valentine
Assistant Professor of Philosophy

Dussault, Marjorie B.
Assistant Professor of Occupational Therapy

Dwyer, Jayne Elizabeth
Assistant Professor of The Arts

Eder, Sidney C.
Assistant Professor of Education

Edwards, John C.
Director of Theater and Associate Professor of Speech and Drama
B.S., Northwestern University, 1950; M.A., ibid., 1952; Ph.D., ibid., 1963.
Appointed 1961.

Edwards, Ruth S.
Assistant Professor of Music

Ellis, B. Robert
Instructor in Mathematics
Appointed 1969.

Ellis, David W.
Vice Provost for Academic Affairs and Associate Professor of Chemistry
Elmore, Ray E., Jr.
Instructor and Coordinator of Exhibitions in The Arts

Emery, Harvard B.
Assistant Professor of Graphics

Engaliehev, Nicholas
Associate Professor of Resource Economics and Extension Economist, Marketing (Forest Products)

Erickson, Raymond L.
Professor of Psychology

Estes, George O.
Assistant Professor of Plant Science

Evans, Rand B.
Associate Professor of Psychology

Faiman, Robert N.
Vice Provost for Research and Special Program Administration, Professor of Electrical Engineering
B.S.E.E., North Dakota State College, 1947; M.S.E.E., University of Washington, 1948; Ph.D., Purdue University, 1956. Appointed 1959.

Fairchild, Thomas P.
Associate Professor of Animal Science and Extension Dairyman

Fan, Stephen S. T.
Associate Professor of Chemical Engineering

Farnsworth, Kirk E.
Psychologist, Assistant Director, Counseling and Testing Center, and Assistant Professor of Psychology

Federer, C. Anthony
Adjunct Associate Professor of Micrometeorology

Fernald, Mary Louise
Associate Professor of Nursing

Fernald, Peter S.
Associate Professor of Psychology

Fink, Stephen L.
Professor of Organizational Development and Psychologist, Counseling and Testing Center

Fisher, Lester A.
Instructor in English

Fisher, G. Thomas
Associate Professor of Entomology and Extension Entomologist
B.S., Iowa State University, 1950; M.S., Rutgers University, 1952; Ph.D., ibid., 1954. Appointed 1969.
Fletcher, Herbert H. (Colonel, USA)
Professor of Military Science
B.S., United States Military Academy, 1946; M.A., University of Missouri, 1966.
Appointed 1969.

Fogg, Marguerite F.
Associate Professor of Nursing
Diploma, Pillsbury Hospital School, 1940; Certificate, Hague Hospital, 1945;

Fogg, Miriam Kay
Lecturer in Medical Technology

Foley, Madeline J.
Lecturer in Music

Forbes, F. William
Assistant Professor of Spanish

Ford, Joseph P.
Assistant Professor of Political Science

Foret, John E.
Assistant Professor of Zoology
Appointed 1967.

Forsyth, G. Alfred
Associate Professor of Psychology

Fort, Marron C.
Associate Professor of German
Appointed 1969.

Foss, Stephen D.
Instructor in Chemical Engineering

†Foster, Bennet B.
Associate Professor of Forest Resources
B.S.F., Colorado State University, 1952; M.F., Oregon State University, 1957; Ph.D., Duke University, 1966.
Appointed 1964.

Fox, Leslie A.
Assistant Professor of Psychology

Francq, Edward N.
Assistant Professor of Zoology
B.S., University of Maryland, 1956; M.S., University of Idaho, 1962; Ph.D., Pennsylvania State University, 1967.
Appointed 1965.

French, E. Elizabeth
Adjunct Assistant Professor of Medical Technology
A.B., Skidmore College, 1943; M.T. (ASCP), Mary Hitchcock Memorial Hospital School of Med. Tech., 1944; M.D.C.M., McGill University Faculty of Medicine, 1950. Appointed 1972.

†Frick, George E.
Adjunct Professor of Resource Economics

Friel, Gerald J.
Head Basketball Coach and Lecturer in Physical Education

Frost, Albert D.
Professor of Electrical Engineering
Appointed 1957.

Gadon, Herman
Professor of Business Administration
A.B., Dartmouth College, 1947; Ph.D., Massachusetts Institute of Technology 1953. Appointed 1964.

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Gardner, Jeanne M.
Assistant Professor of Education

Garrett, Peter W.
Adjunct Assistant Professor of Forest Genetics

Geeslin, William E.
Assistant Professor of Mathematics

Gerhard, Glen C.
Associate Professor of Electrical Engineering
B.S.E., Syracuse University, 1956; M.S.C.E., Ohio State University, 1958; Ph.D., ibid., 1963. Appointed 1967.

Gilbert, C. Gorman
Assistant Professor of Civil Engineering

Giles, Anthony S.
Assistant Professor of Speech and Drama

Gilman, Paul A.
Thompson School Associate Professor of Civil Technology
B.S., University of Vermont, 1938; M.S., Pennsylvania State University, 1951. Appointed 1945.

Gilmore, Robert C.
Associate Professor of History
A.B., University of Vermont, 1944; M.A., McGill University, 1947; M.A., Yale University, 1951; Ph.D., ibid., 1954. Appointed 1952.

Glanz, Filson H.
Associate Professor of Electrical Engineering

Goffe, Lewis C.
Associate Professor of English

Gordon, Bernard K.
Professor of Political Science

Granger, Ralph H.
Thompson School Associate Professor of Applied Business Management and Assistant to the Director of the Thompson School
B.S., Massachusetts State College, 1935; M.S., ibid., 1939. Appointed 1946.

Grant, Clarence L.
Professor of Chemistry

Grant, W. Arthur
Assistant to the President

Gray, Carol J.
Professor of Nursing

Green, Betty D.
Lecturer in Sociology and Anthropology
Hall, Gerald D.
Assistant Professor of Animal Science and Extension Dairy Nutritionist

Hall, Francis R.
Professor of Hydrology

Hall, Helen P.
Lecturer in Home Economics
B.S., Kansas State University, 1941; M.N.S., Cornell University, 1949; Ph.D., ibid., 1953. Appointed 1968.

Hall, Otis F.
Director of the Institute of Natural and Environmental Resources, Professor of Forest Resources
A.B., Oberlin College, 1943; M.F., Yale University, 1948; Ph.D., University of Minnesota, 1954. Appointed 1968.

Halley, Richard D.
Assistant Professor of Speech and Drama

Handy, Allan W.
Lecturer in Occupational Therapy

Haney, Irene K.
Lecturer in German

Haney, James F.
Assistant Professor of Zoology

Hapgood, Robert
Professor of English
Hardy, Hubert A.
Psychologist, Counseling and Testing Service, and Assistant Professor of Education

Harris, F. Conley
Assistant Professor of The Arts

Harris, Larry G.
Assistant Professor of Zoology

Hart, Reina P.
Lecturer, Library

†Harter, Robert D.
Assistant Professor of Soil Chemistry
B.S., Ohio State University, 1961; M.S., ibid., 1962; Ph.D., Purdue University, 1966. Appointed 1969.

Haskell, John R.
Assistant Dean, Whittmore School of Business and Economics and Assistant Professor of Economics and Business Administration

Hatch, John W.
Professor of The Arts

Hebert, David J.
Associate Professor of Education

Heckel, Maynard C.
Associate Dean of the College of Life Sciences and Agriculture; Director, Cooperative Extension Service; Dean, School of Continuing Studies; and Professor of Adult Education

Heidgerd, Lloyd H.
Associate Professor, Biology Branch Librarian

Heilbronner, Hans
Professor of History

Held, Warren H., Jr.
Professor of Classics

†Henry, William F.
Professor of Resource Economics
B.S., Louisiana State University, 1940; M.S., University of Connecticut, 1942. Appointed 1952.

Hepler, Elizabeth M.
Assistant Professor, Serials Librarian

†Herbst, Edward J.
Professor of Biochemistry
B.S., University of Wisconsin, 1942; M.S., ibid., 1944; Ph.D., ibid., 1949. Appointed 1962.

Herr, Guenter K. W.
Assistant Professor of German
M.A., University of Freiburg, Germany, 1956; Ph.D., University of Texas, 1966. Appointed 1968.
Hess, Irvin T.
Professor of Wrestling and Assistant Professor of Physical Education

Hettinger, Stanley D.
Assistant Professor of Music

Heyliger, Donald E.
Instructor in Physical Education

Higbee, Virginia C.
Assistant Professor of Nursing

†Hill, John L.
Professor of Wood Science and Technology
B.S., Colorado State University, 1942; M.S., Yale University, 1947; B.F., ibid., 1954. Appointed 1964.

Hochgraf, Frederick G.
Associate Professor of Materials Science

†Hocker, Harold W., Jr.
Professor of Forest Resources

†Hodgdon, Albion R.
Professor of Botany
B.S., University of New Hampshire, 1930; M.S., ibid., 1932; Ph.D., Harvard University, 1936. Appointed 1930-32, 1936.

Hoff, Phyllis
Associate Professor of Physical Education

Hogan, John A.
Carter Professor of Economics

Hogarth, Karen
Assistant Professor of Physical Education

Holder, Mary E.
Associate Professor of Home Economics

Holt, Charles E., Jr.
Coach of Hockey and Golf, and Lecturer in Physical Education

†Holtz, James B.
Associate Professor of Animal Science

Hooper, Sandra J.
Instructor in Nursing

Hoornbeek, Frank K.
Associate Professor of Zoology

Horrigan, James O.
Associate Professor of Business Administration

Hosek, William R.
Associate Professor of Economics
Houston, Robert E., Jr.
Professor of Physics
B.S., Michigan State University, 1949; M.S., ibid., 1951; Ph.D., Pennsylvania State University, 1957. Appointed 1957.

Howard, Cleveland L.
Assistant Professor of Music

Howarth, Charles H.
Director of the University Health Service

Hoyle, Merrill C.
Adjunct Assistant Professor of Plant Science

Hrabal, John B.
Dean, Office of Institutional Research and Planning, and Professor of Electrical Engineering

Hubbard, Colin D.
Associate Professor of Chemistry

Hudon, Edna S.
Visiting Associate Professor of French

Hudon, Louis J.
Professor of French
A.B., Bowdoin College, 1938; M.A., Yale University, 1942; Ph.D., ibid., 1943. Appointed 1961.

Huffman, Rebecca A.
Instructor in Zoology and Coordinator of Biology “block” program

Hull, John J.
Assistant Professor, Assistant Order Librarian

Hunter, William B., Jr.
Professor of English
A.B., Princeton University, 1937; M.A., Vanderbilt University, 1939; Ph.D., ibid., 1946. Appointed 1968.

†Ikawa, Miyoshi
Professor of Biochemistry
B.S., California Institute of Technology, 1941; M.S., University of Wisconsin, 1944; Ph.D., ibid., 1948. Appointed 1963.

Irwin, Manley R.
Professor of Economics

Jacoby, Frank R.
Assistant Professor of German

Jacoby, Robb
Professor of Mathematics

Jaffe, Marianne H.
Assistant Professor of Speech and Drama

Jagel, John
Assistant Professor of The Arts

James, Jesse
State Leader, Extension 4-H Youth Development, and Associate Professor of Occupational Education
B.S., University of Georgia, 1937; M.S., ibid., 1951. Appointed 1957.
James, Marion E.
Associate Professor of History

Jameson, James J. (Major USA)
Lecturer in Military Science
B.S., United States Military Academy, 1957; M.S., University of Southern California, 1971. Appointed 1971.

†Jansen, Edmund F., Jr.
Associate Professor of Resource Economics

Jefferson, Brian T.
Assistant Professor of The Arts

Jellison, Charles A., Jr.
Professor of History

Jenkins, Melvin E., Jr.
Thompson School Associate Professor of Forest Technology

Jenks, R. Stephen
Associate Professor of Organizational Behavior

Jervis, Frederick M.
Professor of Psychology

Johns, Ray E.
Visiting Professor Whitemore School of Business and Economics
B.S., George Williams College, 1924; M.S.W., University of Michigan, 1940; Ph.D., Columbia University, 1946. Appointed 1970.

Johnson, Richard E.
Professor of Mathematics

Jones, Galen E.
Professor of Microbiology

Jones, Meredith M.
Lecturer in Music

Jones, Paul R.
Professor of Chemistry

Jones, William R.
Professor of History

Kaneko, Jun
Assistant Professor of The Arts

Kaplan, Barry D.
Adjunct Assistant Professor in Hotel Administration

Kaufmann, Richard L.
Associate Professor of Physics

Kauppinen, Tenho S.
Assistant Dean of the College of Technology and Associate Professor of Mechanical Engineering
Kayser, John R.  
Assistant Professor of Political Science  
B.A., University of New Hampshire, 1962;  
M.A., Ohio State University, 1964; Ph.D., Claremont Graduate School and University Center, 1969. Appointed 1969.

*Kieng, Yun Tzu  
Assistant Professor of Plant Science and Genetics  
B.S., Taiwan Normal University, 1957;  

Kimball, Robert O.  
Associate Professor of Mathematics  
B.S., University of New Hampshire, 1941;  

Kimball, Roland B.  
Professor of Education  
B.S., University of New Hampshire, 1942;  

†Klippenstein, Gerald L.  
Associate Professor of Biochemistry  

Klotz, Louis H.  
Associate Professor of Civil Engineering  
B.S.C.E., Pennsylvania State University, 1951; M.C.E., New York University, 1952;  

Knowlton, Elizabeth E.  
Assistant Professor of Physical Education  
B.A., Syracuse University, 1959; M.S., University of Wisconsin, 1967.  
Appointed 1963.

Koch, David W.  
Assistant Professor of Plant Science  

Korbela, John  
Professor of Economics and Business Administration  

Kuo, Shan S.  
Professor of Applied Mathematics  
B.S., National Chung Chen University, 1944; M.S., Ohio State University, 1948;  
Ladd, Dwight R.  
Professor of Business Administration  
A.B., Brown University, 1943; M.B.A.,  
Harvard University, 1949; B.B.A., ibid.,  

Lambert, Robert H.  
Professor of Physics  
B.S., St. Lawrence University, 1952; M.S.,  
Harvard University, 1954; Ph.D., ibid.,  

Lange, Kenneth L.  
Assistant Professor of Mathematics  
B.S., Michigan State University, 1967;  
M.S., Massachusetts Institute of Technol-  
ogy, 1968; Ph.D., ibid., 1971.  
Appointed 1971.

†Langer, Clarence A.  
Professor of Plant Science and  
Extension Horticulturnist, Fruits  
B.S., Michigan State University, 1933;  
M.S., ibid., 1948; Ph.D., ibid., 1952.  
Appointed 1962.

Langley, Harold E., Jr.  
Associate Professor of Civil Engineering  
B.S., University of New Hampshire, 1949;  
S.M., Massachusetts Institute of Technol-  
ogy, 1955; M.S., University of New  
Hampshire, 1956; Sc.D., Massachusetts  
Institute of Technology, 1957.  
Appointed 1961.

Larson, David L.  
Associate Professor of Political Science  
A.B., Dartmouth College, 1952; A.M.,  
Fletcher School, Tufts University, 1957;  
Appointed 1965.

Laurent, John L.  
Professor of The Arts  
B.F.A., Syracuse University, 1948; M.A.T.,  

Lavoie, Marcel E.  
Associate Professor of Zoology  
B.A., St. Anselm's College, 1940; M.S.,  
University of New Hampshire, 1952;  
Ph.D., Syracuse University, 1956.  

Lawson, David W.  
Lecturer in Psychology  
B.A., American International College,  

Lawton, Edward J.  
Assistant Professor of Education  
B.S., North Adams State College, 1955;  
M.A., Fairfield University, 1959; Ed.D.,  
University of Virginia, 1970.  
Appointed 1970.

Leahy, John A., Jr.  
Thompson School Assistant Professor  
of Applied Plant Science  
B.S., University of New Hampshire, 1947.  
Appointed 1966.

Leak, William B.  
Adjunct Associate Professor of Forest  
Resources  
B.S., S.U.N.Y., College of Forestry, Syra-  
cuse University, 1953; M.F., ibid., 1956.  
Appointed 1967.

LeBlanc, Robert G.  
Assistant Professor of Geography  
B.A., University of New Hampshire, 1959;  
M.A., University of Minnesota, 1962;  

Leighton, Charles H.  
Associate Professor of Spanish  
A.B., Harvard College, 1951; A.M., Har-  
vard University, 1953; Ph.D., ibid., 1961.  
Appointed 1956.

Lentz, Sally  
Assistant Professor of English  
B.A., Colorado College, 1965; M.A., Rut-  
gers University, 1969; Ph.D., ibid., 1971.  
Appointed 1971.

Adjunct Associate Professor of Resource  
Economics  
B.S., Louisiana State University, 1952;  
M.A., ibid., 1953; Ed.D., Cornell Uni-  

Lewis, Charles A., Jr.  
Assistant Professor of Recreation  
and Parks  
B.S., New York State Maritime College,  
1959; M.S., Hofstra University, 1962;  
M.A., C. W. Post College, 1966; Ph.D.,  
New York University, 1968.  
Appointed 1972.

Limber, John E.  
Assistant Professor of Psychology  
B.A., University of Illinois, Urbana, 1962;  
Limbert, David E.  
Assistant Professor of Mechanical Engineering  
B.S., Iowa State University, 1964; M.S., Case Western Reserve University, 1965; PH.D., ibid., 1969. Appointed 1969.

Linden, Allen B.  
Assistant Professor of History  

Linsky, Arnold S.  
Associate Professor of Sociology  

Littlefield, Karen A.  
Assistant Professor, Cataloger  

Lockwood, John A.  
Professor of Physics  
A.B., Dartmouth College, Thayer School of Engineering, 1941; M.S., Lafayette College, 1943; PH.D., Yale University, 1948. Appointed 1948.

Loder, Theodore C., III  
Visiting Assistant Professor of Earth Sciences  

Logan, Terence P.  
Associate Professor of English  

Long, David F.  
Professor of History  

†Loy, James B.  
Assistant Professor of Plant Science  

Lucha, Carol A.  
Instructor in Speech and Drama  

Lyle, Gloria G.  
Associate Professor of Chemistry  
B.A., Vanderbilt University, 1944; M.S., Emory University, 1946; PH.D., University of New Hampshire, 1958. Appointed 1951.

Lyle, Robert E., Jr.  
Professor of Chemistry  
B.A., Emory University, 1945; M.S., ibid., 1946; PH.D., University of Wisconsin, 1949. Appointed 1951.

Lynch, Darrel D. (Major, USAF)  
Lecturer, Aerospace Studies  

Machardy, William F.  
Assistant Professor of Plant Pathology and Extension Plant Pathologist  

*Macklin, Jerry M.  
Associate Professor of Entomology and Assistant Director, Cooperative Extension Service  
B.S., Purdue University, 1952; M.S., ibid., 1956; PH.D., ibid., 1971. Appointed 1972.

Magidson, David J.  
Associate Professor of Speech and Drama  

Magnuson, Allen H.  
Visiting Assistant Professor of Mechanics  

Majors, William  
Associate Professor of The Arts  
Mandell, Charlotte C.
Lecturer in Psychology

Marple, Sylvia H.
Assistant Professor of Home Economics and Extension Nutrition Specialist

Marquay, Gertrude Martha
Lecturer in Medical Technology

Marschner, Donald C.
Professor of Business Administration

Marshall, Grover E.
Assistant Professor of French

Marshall, Thomas O.
Professor of Education
A.B., Colgate University, 1929; Ed.M., University of Buffalo, 1933; Ed.D., Harvard University, 1941. Appointed 1947.

Matheson, Raymond E.
Foreign Student Adviser, and Director of Cultural Events

Matheson, Arthur C.
Associate Professor of Botany and Director of the Jackson Estuarine Laboratory

†Mautz, William W.
Assistant Professor of Wildlife Ecology

McCann, Francis D., Jr.
Assistant Professor of History

McDonough, Robert
Visiting Assistant Professor in Business Administration

Mead, Jean M.
Lecturer in Physical Education and Coach

Meagher, Judith A.
Assistant Professor of Education

Meeker, Loren David
Associate Professor of Mathematics

Melvin, Donald W.
Associate Professor of Electrical Engineering
B.S., University of New Hampshire, 1955; M.E., Yale University, 1957; Ph.D., Syracuse University, 1970. Appointed 1957.

Menge, Carleton P.
Professor of Education

Mennel, Robert M.
Assistant Professor of History

Merritt, Richard D.
Associate Professor of The Arts

Merton, Andrew H.
Instructor in English
 Messier, Victor R.  
*Instructor in Home Economics*  

Metealf, Theodore G.  
*Professor of Microbiology*  
B.S., Massachusetts College of Pharmacy, 1940; Ph.D., University of Kansas, 1950. Appointed 1956.

Michael, Joseph E., Jr.  
*Lecturer in Law, Whittemore School*  

Miller, Edmund G.  
*Professor of English*  

Mills, Betty J.  
*Assistant Professor of Physical Education*  

Mills, Eugene S.  
*Provost and Professor of Psychology*  

Mills, Richard L.  
*Assistant Professor of Economics and Business Administration*  

Milne, Lorus J.  
*Professor of Zoology*  
B.A., University of Toronto, 1933; M.A., Harvard University, 1934; Ph.D., *ibid.*, 1936. Appointed 1948.

Mitchell, James R.  
*Associate Professor of Plant Science and Extension Agronomist, Forage Crops*  

Mittelstaedl, Arthur H.  
*Visiting Lecturer in Recreation and Parks*  

Moak, Peter V.  
*Assistant Professor of The Arts*  

Mooradian, Andrew T.  
*Director, Department of Intercollegiate Athletics, and Associate Professor of Physical Education*  
B.S., University of New Hampshire, 1948; M.S., Boston University, 1958. Appointed 1950.

Moore, Asher  
*Donald C. Babcock Professor of Philosophy*  

Moore, Berrien, III  
*Assistant Professor of Mathematics*  

Moore, David W.  
*Assistant Professor of Political Science*  

Moore, Gary S.  
*Assistant Professor of Medical Technology*  

Morin, Robert R.  
*Assistant Professor, Coordinator Cooperative Library Service*  
Morris, Douglas E.
Assistant Professor of Resource Economics

Morrison, James D.
Professor of Chemistry

Morrison, Jean M.
Assistant Professor of Physical Education

Mosberg, William
Associate Professor of Mechanical Engineering

Mower, Lyman
Professor of Physics
B.S., University of California, 1949; Ph.D., Massachusetts Institute of Technology, 1953. Appointed 1957.

Mulhern, John E., Jr.
Professor of Physics

Mulligan, Hugh F.
Associate Professor of Botany

Munroe, M. Evans
Professor of Mathematics
B.A., University of Texas, 1940; Sc.M., Brown University, 1941; Ph.D., ibid., 1945. Appointed 1959.

Murdoch, Joseph B.
Professor of Electrical Engineering

Murray, Donald M.
Professor of English

Murray, Frederick P.
Associate Professor of Speech and Drama

Myers, Norman W.
Vice President-Treasurer

Neff, John C.
Lecturer in Medical Technology

Nevin, John A.
Professor of Psychology

Newman, Anthony K.
Assistant Professor of Electrical Engineering

Newman, Jane E.
Dean of Students

Nichols, Ernest E.
Instructor in Electrical Engineering

Nicol, William
Lecturer in Music
Nicoloff, Philip L.
Professor of English

Nielsen, John P.
Associate Professor of Civil Engineering

Nielson, Melville
Associate Dean of the College of Liberal Arts and Associate Professor of Sociology
B.S., Bowling Green State University, 1942; M.A., Ohio State University, 1947; Ph.D., ibid., 1955. Appointed 1950.

Nordell, Lawrence P.
Visiting Associate Professor in Economics

Nordgren, Eric A.
Associate Professor of Mathematics

Norton, Robert C.
Assistant Coach and Lecturer in Physical Education

O’Connell, Lawrence W.
Assistant Professor of Political Science

O’Connor, J. David
Freshman Football Coach and Lecturer in Physical Education

O’Connor, James T., Jr.
Associate Professor of Animal Science and Extension Animal Scientist

O’Donnell, Dorothy C.
Associate Professor of Home Economics and Extension Interior Design Specialist

Olsen, James II.
Assistant Professor, Assistant to the Librarian

Olson, David P.
Associate Professor of Wildlife Ecology, Extension Wildlife Specialist

O’Neil, C. Michael
Director, University Recreation Services, and Lecturer in Recreation and Parks

Owens, Charles W.
Associate Professor of Chemistry

Paella, Natalo A.
Lecturer in Music

Palmer, Stuart H.
Professor of Sociology

Peck, Rhoda M.
Assistant Professor of Home Economics and 4-H Program Specialist

*Peirce, Lincoln C.
Professor of Plant Science
Perkins, Jane E.  
Lecturer in Medical Technology  

Peters, Dwight R.  
Intercollegiate Athletics Assistant Coach and Lecturer in Physical Education  

Peters, Joan A.  
Assistant Professor of Home Economics and Program Leader, Consumer Education and Information  

†Peterson, Nobel K.  
Associate Professor of Soil and Water Science  
B.S., Kansas State College, 1948; M.S., Purdue University, 1950; Ph.D., Rutgers University, 1957. Appointed 1957.

Petroski, Joseph J.  
Associate Professor of Education  

Pew, Richard H.  
Associate Professor of Hotel Administration  
B.S., Cornell University, 1933.  
Appointed 1963.

Pfanner, Helmut F.  
Associate Professor of German  
Teaching Credential, Teachers Training College, Austria, 1952; M.A., Stanford University, 1961; Ph.D., ibid., 1965.  
Appointed 1969.

Pfordresher, John C.  
Assistant Professor of English  
B.A., Georgetown University, 1965; Ph.D., University of Minnesota, 1970.  
Appointed 1970.

Phillips, William  
Coach of Track and Lecturer in Physical Education  
B.S., University of New Hampshire, 1970.  
Appointed 1970.

Pierce, Robert S.  
Adjunct Associate Professor of Forest Resources and Soil and Water Science  

Pilar, Frank L.  
Professor of Chemistry  
B.S., University of Nebraska, 1951; M.S., ibid., 1953; Ph.D., University of Cincinnati, 1957. Appointed 1957.

Pine, Gerald J.  
Professor of Education  

Pine, Mary A.  
Lecturer in Education  

Pistole, Thomas  
Assistant Professor of Microbiology  

Pokoski, John L.  
Associate Professor of Electrical Engineering  
B.S., St. Louis University, 1959; M.S., Arizona State University, 1965; Ph.D., Montana State University, 1967. Appointed 1967.

Polk, Keith  
Associate Professor of Music  

Poll, Solomon  
Professor of Sociology  

†Pollard, James E.  
Assistant Professor of Plant Science  
Potter, Hugh M., III
Assistant Professor of English
Appointed 1962.

Prince, Allan B.
Vice Provost for Budget and Administration and Professor of Soil and Water Science

Pritchard, Hugh C.
Professor, Reference Librarian

Puth, Robert C.
Assistant Professor of Economics

Radlow, James
Professor of Applied Mathematics
B.A., City College, New York, 1943; Sc.M., Brown University, 1945; Ph.D., New York University, 1957.
Appointed 1965.

Randall, Donald R.
Lecturer in Education

Rasmussen, Mary H.
Associate Professor of Music

Reed, Robert C.
Associate Professor, Order Librarian

†Reeves, Roger Marcel
Associate Professor of Entomology and Forest Resources

Reid, Elaine B.
Instructor in Psychology

Reid, Samuel R.
Professor of Business Administration and Economics
B.S., St. Louis University, 1950; M.S., ibid., 1959; Ph.D., ibid., 1962. Appointed 1969.

†Repka, Frank J.
Assistant Professor of Animal Science

†Rich, Avery E.
Professor of Plant Pathology and Associate Dean, College of Life Sciences and Agriculture

Richardson, John C.
Professor of English
A.B., Dartmouth College, 1941; M.A., Columbia University, 1942; Ph.D., Boston University, 1959. Appointed 1946.

Ringrose, Richard C.
Professor of Animal Science
B.S., Cornell University, 1932; Ph.D., ibid., 1936. Appointed 1942.

Roberts, Lewis, Jr.
Thompson School Associate Professor of Applied Science and Director of Thompson School of Applied Science
Robinson, Frederick J.
Associate Director, Merrimack Valley
Branch and Assistant Professor of
Mathematics
B.S., University of New Hampshire, 1949;

Roelof, Edmond C.
Assistant Professor of Physics
A.B., University of California, Los Ange-
les, 1959; Ph.D., University of California,

Rogers, Ada-Louise H.
Visiting Assistant Professor of Music
B.A., B.M., Brenau College, 1944; M.S.,
Juilliard School of Music, 1949.
Appointed 1967.

Rogers, John E.
Associate Professor of Music
B.A., B.M., University of Georgia, 1960;
M.M., Yale University, 1962; M.F.A.,
Princeton University, 1966.
Appointed 1967.

†Rogers, Owen M.
Professor of Plant Science
B.V.A., University of Massachusetts, 1952;
M.S., Cornell University, 1954; Ph.D.,
Pennsylvania State University, 1959.
Appointed 1959.

Rohrabacher, Evelyn H.
Thompson School Assistant Professor of
Communications
B.A., St. Joseph College, 1941; M.A., Uni-
versity of South Florida, 1968.
Appointed 1971.

Romoser, George K.
Professor of Political Science
A.B., Rutgers University, 1951; A.M., Uni-
versity of Chicago, 1954; Ph.D., ibid.,

Rose, Alan H.
Assistant Professor of English
B.A., University of Pennsylvania, 1960;
M.A., New York University, 1961; Ph.D.,

Rose, Harriet A.
Lecturer in English
B.A., Rutgers University, 1962; M.A., New

Rosen, Sam
Professor of Economics
A.B., University of Wisconsin, 1942; A.M.,
Harvard University, 1948; Ph.D., ibid.,

Rosenbush, Michael J.
Assistant Professor of Russian
B.A., McGill University, 1957; M.A., Uni-
versité de Montreal, 1964; Ph.D., ibid.,

Ross, Shepley L.
Professor of Mathematics
A.B., Boston University, 1949; A.M., ibid.,
1950; Ph.D., ibid., 1953.
Appointed 1955.

Rothwell, Kenneth J.
Professor of Economics
B.A., University of Western Australia,
1949; M.A., ibid., 1955; Ph.D., Harvard

Rouman, John C.
Associate Professor of Classics
B.A., Carleton College, 1950; M.A., Co-
lumbia University, 1951; Ph.D., Uni-
versity of Wisconsin, 1965.
Appointed 1965.

†Routley, Douglas G.
Professor of Plant Science and
Biochemistry
B.S.A., University of British Columbia,
1952; M.S., Pennsylvania State Uni-
versity, 1953; Ph.D., ibid., 1957.
Appointed 1957.

Rowe, Martha W.
Assistant Professor of Nursing
Diploma, Salem Hospital School of Nurs-
ing, 1958; B.S.N., Simmons College, 1962;
M.S., Boston University, 1964.
Appointed 1970.

Rupp, Nancy C.
Assistant Professor of Physical Education
B.S., Sargent College, Boston University,
1950; M.A., State University of Iowa,

Rutman, Darrett B.
Professor of History
A.B., University of Illinois, 1950; Ph.D.,
University of Virginia, 1959.
Appointed 1968.
Sabatelli, Philip J.
*Assistant Professor of Speech and Drama*

St. Onge, Richard N.
*Assistant Professor of Physics*

Samuels, Fred
*Associate Professor of Sociology*

Sandler, Mel
*Associate Professor of Hotel Administration*
B.S., Georgetown University, 1941; M.A., Northwestern University, 1947; C.P.A. Appointed 1970.

Sarkady, Antal A.
*Instructor in Electrical Engineering*

Sasner, John J., Jr.
*Associate Professor of Zoology*

Savage, Eugene Arnold
*Director of Admissions*

Savage, Godfrey H.
*Professor of Mechanical Engineering*

Sawyer, Albert K.
*Associate Professor of Chemistry*
A.B., Colby College, 1940; M.S., University of Maine, 1947. Appointed 1949.

Sawyer, Philip J.
*Professor of Zoology*

Scharff, Robert C.
*Assistant Professor of Philosophy*

Sehbanoff, Susan
*Assistant Professor of English*

Schmidt, Marty J.
*Assistant Professor of Psychology*

Schneer, Cecil J.
*Professor of Geology*

Schomaker, Linda
*Instructor in Home Economics*

†Schreiber, Richard W.
*Professor of Botany*

Schwarz, Marc L.
*Associate Professor of History*

Scott, William H.
*Thompson School Instructor of Applied Business Management*
Seiler, David E.
**Assistant Professor of Music**

Seperson, Marvin A.
**Assistant Professor of Education**

Shapiro, Howard M.
**Assistant Professor of Sociology**

Shar, Albert O.
**Assistant Professor of Mathematics**

Shattuck, Gerald B.
**Lecturer in Occupational Therapy**

Shaw, Winifred C.
**Associate Professor of The Arts**

Shepard, Harvey K.
**Assistant Professor of Physics**

Sherman, Heidemarie C.
**Assistant Professor of Economics**

Sherman, James L.
**Assistant Professor of German**

Shigo, Alex L.
**Adjunct Professor of Plant Pathology**

Shor, Ronald E.
**Associate Professor of Psychology**

Shore, Samuel D.
**Associate Professor of Mathematics**

Siddall, David V.
**Assistant Professor of English**

Siegars, Jessica A.
**Assistant Professor of Occupational Therapy**

Silva, J. Donald
**Thompson School Associate Professor of Communications**

Silverman, Robert J.
**Professor of Mathematics**

Simpson, Robert E.
**Associate Professor of Physics**

Sims, Wilburn L.
**Assistant Professor of Speech and Drama**
Singer, Frank P.
Thompson School Assistant Professor of Forest Technology

Sir, W. Niel
Assistant Professor of Music

Sivaprasad, Kondagunta
Assistant Professor of Electrical Engineering

Skelton, John B.
Lecturer in Music

†Skoglund, Winthrop C.
Professor of Animal Science

Skutt, H. Richard
Professor of Electrical Engineering

†Slanetz, Lawrence W.
Dean, School of Health Studies and Professor of Microbiology
B.S., Connecticut State College, 1929; Ph.D., Yale University, 1932. Appointed 1932.

Slater, Steven M.
Assistant Professor of Chemical Engineering

Sloan, Roger P.
Assistant Professor of Forest Resources and Extension Forester

Smith, Elizabeth C.
Lecturer in Animal Science
B.S., St. Lawrence University, 1951; M.S., Pennsylvania State University, 1954; Ph.D., ibid., 1958. Appointed 1968.

Smith, Gerald L.
Associate Professor of Animal Science and Extension Animal Scientist

Smith, James A.
Associate Dean of the College of Liberal Arts and Adjunct Associate Professor of Economics

Smith, M. Daniel
Associate Professor of Education

Smith, Mark R.
Associate Professor of English

†Smith, Samuel C.
Professor of Animal Science and Biochemistry

Snell, Elizabeth
Associate Professor of Home Economics

Soukaris, Pauline
Associate Professor of Social Work

Spitz, Allan A.
Dean, College of Liberal Arts
and Professor of International Relations
Sprague, Linda G.
Assistant Professor of Business Administration

Stackhouse, Larry L.
Assistant Professor of Animal Science

Steele, Donald E.
Professor of Music

Stern, Michael M.
Assistant Professor of Electrical Engineering

Stone, Deborah E.
Assistant Professor of Education

Stotz, Kerwin C.
Associate Professor of Electrical Engineering

Stram, Sarah T.
Lecturer in Psychology

Straus, Murray A.
Professor of Sociology

Strout, Beverly B.
Instructor in English

Stuart, Elena F.
Lecturer in Speech

Swan, Emery F.
Professor of Zoology
B.S., Bates College, 1938; Ph.D., University of California, 1942. Appointed 1952.

Sweeney Jean Elizabeth
Lecturer in Education and Director, Career Opportunities Program

Sylvestre, Robert P.
Associate Professor of Philosophy

Sylvester, Robert P.
Associate Professor of Philosophy
Taft, Charles K.
Professor of Mechanical Engineering

Tattar, Terry A.
Adjunct Assistant Professor of Plant Pathology

Tebbetts, Diane R.
Library, Instructor

Teeri, Arthur E.
Professor of Biochemistry
B.S., University of New Hampshire, 1937; M.S., ibid., 1940; Ph.D., Rutgers University, 1943. Appointed 1938-40, 1943.

Terninko, John
Assistant Professor of Business Administration
B.S.E.E., Newark College of Engineering, 1961; M.S., Massachusetts Institute of Technology, 1962; Ph.D., Case-Western Reserve University, 1968. Appointed 1967.

Thomas, George R.
Professor of The Arts

Tillinghast, Edward K.
Associate Professor of Zoology

Tischler, Herbert
Professor of Geology

Torrest, Robert S.
Assistant Professor of Chemical Engineering

Trout, Ben T.
Assistant Professor in Political Science

Turner, Leslie C.
Registrar

Uebel, J. John
Associate Professor of Chemistry

Ulrich, Gail D.
Assistant Professor of Chemical Engineering

Urban, Willard E., Jr.
Associate Professor of Biometrics and Assistant Director, Agricultural Experiment Station

Vafa, Reza
Visiting Assistant Professor of Business Administration
B.A., Miami University, 1964; D.B.S., Research Institute for Management Sciences, Delft Technological University, the Netherlands, 1966. Appointed 1972.

Valentine, Russell L.
Associate Professor of Mechanical Engineering
Certificate in Machine Design, Wentworth Institute, 1942; B.S., Michigan State College, 1951; M.S.M.E., Purdue University, 1953. Appointed 1953.

Valenza, Daniel L.
Associate Professor of The Arts
Van Osdl, Donavan Harold
Assistant Professor of Mathematics

Verrette, Paul F.
Assistant Professor of Music

Vicearo, Thomas J.
Instructor in Social Work

Vincent, Donald E.
Professor, Librarian

Vittands, Elizabeth
Instructor in Nursing

Vittands, Ingvars J.
Lecturer in Occupational Therapy

Voll, John O.
Assistant Professor of History

Vreeland, Robert P.
Associate Professor of Civil Engineering
B.S., Yale University, 1932; M.S., Columbia University, 1933; M.E., Yale University, 1941. Appointed 1966.

Vrooman, Jack R.
Associate Professor of French

Wadsworth, Richard A. (Captain, USAF)
Lecturer, Aerospace Studies

Walker, Charles F.
Instructor in Electrical Engineering

Walker, Ian M.
Assistant Professor of The Arts

Wallace, Oliver P., Sr.
Associate Professor of Forest Resources
B.S., University of New Hampshire, 1937; B.S.F., University of Michigan, 1938; M.F., ibid., 1947; Ph.D., ibid., 1954. Appointed 1953.

Wallace, William H.
Professor of Geography
B.S., Beloit College, 1948; M.S., University of Wisconsin, 1950; Ph.D., ibid., 1956. Appointed 1957.

Wallen, Jacqueline
Lecturer in Home Economics

Walsh, Anthony A.
Instructor in Psychology

Walton, Julian Eldon
Instructor, Audio-Visual Librarian

Wang, Rosemary Y.
Assistant Professor of Nursing

Wang, Tung-Ming
Associate Professor of Civil Engineering
Ward, Elizabeth A.  
Clinical Instructor in Medical Technology  
B.S., University of New Hampshire, 1947;  

Ward, Judith D.  
Instructor in Occupational Therapy  
B.S., University of New Hampshire, 1964.  
Appointed 1972.  

Warren, Jerry A.  
Director of Academic Computing Activities and Associate Professor of Plant Science  

Waterfield, D. Allan  
Assistant Professor of Physical Education  
Appointed 1970.  

Watkins, Nancy M.  
Assistant Professor of Nursing  

Watson, Deborah  
Assistant Professor, Cataloger  

Watson, Robert I.  
Professor of Psychology  

Wear, Louise F.  
Lecturer in Music  
B.M., Oberlin Conservatory, 1940.  
Appointed 1972.  

Wear, Robert E.  
Associate Professor of Physical Education  

Webb, Dwight  
Associate Professor of Education  

Webber, Launcel E.  
Research Professor and Associate Director, Center for Institutional and Industrial Development  
B.S., University of New Hampshire, 1934; M.E., ibid., 1940; M.S., ibid., 1946. Appointed 1937.  

Webber, William R.  
Professor of Physics  
B.S., Coe College, 1951; M.S., University of Iowa, 1955; Ph.D., ibid., 1957. Appointed 1969.  

Weber, James H.  
Associate Professor of Chemistry  
B.S., Marquette University, 1959; Ph.D., Ohio State University, 1963.  
Appointed 1963.  

Weber, Stephen J.  
Assistant Professor of Psychology  

Weeks, Silas B.  
Associate Professor of Resource Economics and Extension Community Resource Development Specialist  
B.S., Cornell University, 1937. Appointed 1954.  

Weesner, Theodore W.  
Assistant Professor of English  

Weiland, Walter E.  
Associate Professor of Physical Education  

Wells, Donald D.  
Instructor in Business Administration  
Wells, Otho S.
Associate Professor of Plant Science and Extension Horticulturist, Vegetables

West, Paul T. (Major, USAF)
Lecturer, Aerospace Studies

West, Wilfred W. (Lt. Colonel, USA)
Lecturer in Military Science

Wetzel, William E.
Associate Professor of Business Administration

Weyrick, Richard R.
Associate Professor of Forest Resources

Wheeler, Charles M., Jr.
Associate Professor of Chemistry
B.S., West Virginia University, 1947; M.S., ibid., 1949; Ph.D., ibid., 1951. Appointed 1950.

Wheeler, Douglas L.
Associate Professor of History

Wheeler, Ellsworth H., Jr.
Assistant Professor of Zoology

White, Susan O.
Assistant Professor of Political Science

Whitlock, John B.
Associate Professor of Music

Whitman, Kathryn M.
Instructor in Occupational Therapy
Diploma, Boston School of Occupational Therapy, 1945. Appointed 1968.

Whitney, Jean M.
Lecturer in English

Whittier, Duane H.
Associate Professor of Philosophy

Wicks, John D.
Professor of Music

Wilcox, Donald J.
Associate Professor of History

Wilkinson, Maurice
Visiting Lecturer in Economics

Williams, Daniel C.
Assistant Professor of Psychology

Williams, Thomas A., Jr.
Professor of English

Willits, Robin D.
Associate Professor of Business Administration
Wilson, John A.
Assistant Professor of Mechanical Engineering

Wing, Barbara H.
Instructor of Spanish

Wing, Henry J., Jr.
Assistant Professor of Music

Winn, Alden L.
Professor of Electrical Engineering

Woodruff, John H.
Associate Professor of Political Science

Wright, Claire W.
Academic Counselor, Office of the Dean of Liberal Arts, and Instructor in Education

Wright, John J.
Assistant Professor of Physics

Wright, Paul A.
Professor of Zoology

Wrightsman, Dwayne E.
Associate Professor of Finance

Wurzburg, Frederic W.
Associate Professor of Political Science

Yang, Jane C.
Assistant Professor, Catalog Department Coordinator

Yen, Yin-Chao
Visiting Professor of Chemical Engineering
B.S., National Taiwan University, 1951; M.S., Kansas State University, 1956; Ph.D., Northwestern University, 1960. Appointed 1965.

Yildiz, Asim
Professor of Mechanics

Yildiz, Musa
Visiting Professor in Applied Mathematics
B.S., St. Louis University, 1951; M.S., ibid., 1952; Ph.D., Stevens Institute of Technology, 1967. Appointed 1972.

Young, Paul Campbell
Lecturer in Occupational Therapy

Yonni, John A.
Associate Professor of English

Zabarsky, Melvin J.
Associate Professor of The Arts

Zaso, Gus C.
Associate Professor of Recreation and Parks
Zoller, J. Harold  
Professor of Civil Engineering  
B.S.C.E., University of Wyoming, 1941;  
B.S.S.E., University of Illinois, 1945;  
Ph.D., University of Wisconsin, 1953.  
Appointed 1958.

Zsigray, Robert M.  
Assistant Professor of Microbiology  
A.B., Miami University, 1961; M.S., Georgetown University, 1967; Ph.D., ibid., 1968.  
Appointed 1970.

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**Professional Staff, Instruction and Research**

Adams, John P.  
University Photographer  
Franklin Technical Institute, 1957.  
Appointed 1959.

Andrews, Ronald C.  
Staff Associate, Center for Institutional and Industrial Development  
B.S., University of New Hampshire, 1970.  
Appointed 1971.

*Ballard, Horace C.*  
Agricultural Agent, Belknap County  
B.S., Cornell University, 1936.  
Appointed 1949.

*Barker, Floyd V.*  
Extension Environmental Quality Specialist  
B.S., University of Maine, 1948.  
Appointed 1967.

*Barney, Dwight*  
Assistant Extension Livestock Specialist and Farm Coordinator  
B.S., University of New Hampshire, 1968.  
Appointed 1971.

Beckingham, Kathleen R.  
Supervisor of Testing, Counseling and Testing Center  

*Black, Donald C.*  
Forester, Strafford County  
B.S., University of Massachusetts, 1963.  
Appointed 1971.

Booska, Emery P.  
Assistant to the Dean, College of Life Sciences and Agriculture  
Appointed 1966.

Boyle, Joseph R.  
Project Engineer, Center for Institutional and Industrial Development  
B.S., University of New Hampshire, 1961.  
Appointed 1971.

*Breck, Robert W.*  
Forester, Hillsborough County  
B.S., University of New Hampshire, 1940; M.F., Yale School of Forestry, 1941.  
Appointed 1947.

*Brewitt, Peter D.*  
Acting Forester, Belknap County  

*Brook, Munro S.*  
4-H Youth Development Agent,  
Coos County  
Appointed 1967.

*Buck, Charles W.*  
4-H Youth Development Agent,  
Hillsborough County  
B.S., University of Maine, 1951; M.S., University of New Hampshire, 1968.  
Appointed 1955.

*Butterfield, Marcius R.*  
4-H Youth Development Agent,  
Cheshire County  
B.S., University of Vermont, 1958; M.S., University of New Hampshire, 1971.  
Appointed 1962.

Burgio, Ralph E.  
Information Specialist, Division of Continuing Education  
Appointed 1972.

Chinburg, Dale L.  
Staff Associate, Center for Industrial and Institutional Development  
B.S., Upper Iowa University, 1952; B.A., University of Iowa, 1959; M.S., ibid., 1960.  
Appointed 1972.
Clark, Patrick C.
Professional Biologist

*Clark, Virginia E.
Extension Home Economist,
Merrimack County
B.E., Keene State College, 1942.
Appointed 1963.

Clarke, E. Warren
Coordinator, Emergency Planning and Operations

*Clement, Bruce A.
Agricultural Agent, Cheshire County

*Colby, Perley D.
Agricultural Agent, Hillsborough County

*Conde, John A.
Forester, Merrimack County

Cooney, Carol C.
Extension Home Economist,
Sullivan County

*Corry, Henry W., Jr.
Extension Editor
B.S., Boston University, 1948. Appointed 1953.

*Currier, Muriel B.
Extension Home Economist,
Grafton County

Dame, Barry
Staff Associate, Center for Industrial and Institutional Development

*Damon, John F.
Extension Area Agent, RC&D

*Danko, Thomas
Extension Area Agent, Poultry Management; Cheshire, Hillsborough, and Merrimack Counties and assistance in all counties

Davenport, Richard W.
Research Associate in Chemistry

deLara, Frances S.
Professional Botanist

*Dodge, Arthur G., Jr.
Extension Area Forester, RC&D

DuBois, Thomas E.
Clinical Psychologist, Counseling and Testing Center

Dudley, Dudley W.
Staff Associate, Department of Sociology

*Ellison, Daniel G.
Extension Area Agent, Resource Development

English, Robert A.
Coordinator and Lecturer in Health Care Administration, Division of Continuing Education
Ensign, Gary C.
Staff Assistant, Division of Continuing Education
B.S., Rochester Institute of Technology, 1964; M.S., Bucknell University, 1965; M.S., Syracuse University, 1967; Ph.D., University of Michigan, 1972.
Appointed 1972.

*Fabrizio, Richard F.
4-H Youth Development Agent, Grafton County

*Ferguson, John R., Jr.
Forester, Cheshire County

Field, Kenneth A., Jr.
Resources Management Emergency Planning and Operations

†Fiske, Paul R.
State Leader of Community Development

Fitzgerald, John J.
Research Associate in Chemistry

Flowers, John M., III
Research Associate in Chemistry

Forrest, David J.
Research Associate, Department of Physics

Freer, Kenneth O.
Assistant to the Dean, Graduate School

*Garland, Lynn B.
4-H Youth Development Agent, Rockingham County

*George, Ernest A.
Extension Area Agent, Dairy; Cheshire, Hillsborough, Rockingham, and Strafford Counties

*Gilman, Francis E.
Extension Agricultural Engineer

*Goss, Martha L.
Program Coordinator, EFNEP

Grady, James E.
County 4-H Youth Development Agent, Belknap County

Guare, Richard
Talent Search, Model City Coordinator

*Gundry, Barbara C.
Extension Home Economist, Nutrition, Hillsboro County

Hagmann, Erick L.
Chemist, Center for Industrial and Institutional Development

*Head, Ivan E.
4-H Youth Development Agent, Sullivan County
Hohmann, Agnes
Academic Counselor, Office of the Dean of Liberal Arts, and Lecturer in Education

*Howe, Gerald W.
Agricultural Agent, Strafford County

Hutchinson, Barry T.
Botanist

Johnson, Merna E.
Assistant Director, Division of Continuing Education

*Kosslyn, Dorothy
Chemist and Seed Analyst

*Kendall, Shirley M.
Extension Home Economist, Cheshire County

*Kennedy, Kevin B.
Extension Area Agent, Dairy; Grafton and Coos Counties

*Kincade, Merle F.
Extension Home Economist, Belknap County

*Kinder, Richard G.
Associate Forester, Grafton County

Klumpar, David
Research Associate in Space Science Center

*Knoop, William
Extension Turfgrass Specialist, Plant Science

*Knowles, Stanley W.
Forester, Rockingham County

*Knox, Harry B.
4-H Youth Development Agent, Rockingham County

Kontrelakos, Peter
Biochemist

Lacroix, Karol A.
Project Coordinator, Faculty Interaction in Medical Technology

*Leighton, Roger S.
State Leader Forestry and CFM Supervisor
B.S., University of New Hampshire, 1941. Appointed 1952.

Lezniak, Jerry A.
Research Associate, Department of Physics

Livas, Basil L.
Staff Associate, Center for Institutional and Industrial Development

Loranger, Paul M.
Project Director, Talent Search

*Lord, Carleton R.
4-H Youth Development Agent, Carroll County
*Lord, William G.
Agricultural Agent, Sullivan County

*Levering, Edith L.
Extension Home Economist, Rockingham County

Majors, Susan S.
Gallery Director, Department of The Arts

*Marty, Mamie
Extension Home Economist, Strafford County

McCusker, Andrew
Biologist

*McQuire, Lena F.
Extension Home Economist
Belknap County

Miller, Bruce
Research Associate, EDAL

Moore, Donald A.
Director, Center for Institutional and Industrial Development, and Assistant to the Dean, College of Technology

*Morse, Wallace J.
Entomologist
B.S., University of New Hampshire, 1943. Appointed 1943.

Murphy, Carmita A.
Acting Associate Director of the Division of Continuing Education

Nielsen, Ivan K.
Research Associate in Chemistry

*Nissen, Harriet J.
Extension Home Economist, Hillsborough County

Nordholm, Joel E., Jr.
Agricultural Agent, Sullivan County

Ouellette, Carol A.
Parasitologist

Patmos, Ray M., Jr.
Assistant County Forester, Coos County

Pelton, Paul A.
Chemist, Center for Institutional and Industrial Development

Pinney, Carol
Professional Botanist

*Piwowar, John S.
Extension Area Agent, Dairy; Belknap, Carroll, Merrimack, and Sullivan Counties

*Pohl, Peter W.
Forester, Carroll County

Portlock, David E.
Research Associate in Chemistry
B.S., Southwestern Massachusetts University, 1966; M.S., Central Michigan University, 1968; Ph.D., Virginia Polytechnic Institute, 1972. Appointed 1972.
Post, Donald E.
Greenhouse Superintendent
B.S., University of New Hampshire, 1972.
Appointed 1972.

*Pratt, Leighton C.
Agricultural Agent, Coos County
B.S., University of Vermont, 1951; M.S.,
University of Rhode Island, 1953.
Appointed 1969.

*Robie, Dwight A.
4-H Youth Development Agent,
Merrimack County
B.S., University of New Hampshire, 1971.
Appointed 1971.

Rowe, Robert
Assistant to the Dean, Whittemore
School of Business and Economics,
and Staff Associate, Center for
Institutional and Industrial Development
A.B., Trinity College, 1955;
M.B.A., Boston University, 1968.
Appointed 1970.

*Sargent, Leslie B., Jr.
Forester, Grafton County
B.S., University of New Hampshire, 1943.
Appointed 1954.

Savage, Audrey C.
Administrative Assistant, Center for
Institutional and Industrial Development
Appointed 1971.

Scheibel, Deborah J.
Conference Coordinator, Division of
Continuing Education
B.A., Adelphi University, 1940.
Appointed 1971.

*Schroeder, Calvin E.
4-H Youth Development Agent,
Strafford County
B.S., University of New Hampshire, 1967.
Appointed 1969.

*Scott, Donald H.
Forester, Belknap County
B.S., Michigan Technical University,
1956; M.S., University of Michigan, 1957.
Appointed 1969.

*Seavey, David C.
Agricultural Agent, Merrimack County
A.A.S., Thompson School of Agriculture,
1963; B.S., University of Rhode Island,
1966; M.S., University of New Hampshire,

Shevenell, Thomas C.
Research Associate in Earth Sciences
Appointed 1972.

Shoobs, Dorothy S.
Project Coordinator, Curriculum Study
for Revision
Diploma in Nursing, Newark Beth Israel
Hospital, 1946; B.S., New York University,

Soper, Margaret B.
Assistant Director of the Division
of Continuing Education
B.A., University of New Hampshire, 1939.
Appointed 1966.

Sorenson, David C.
Agricultural Agent, Carroll County
B.S., University of Rhode Island, 1964;

Stevens, Helen B.
Project Coordinator, Continuing
Education in Restorative Care, Division of
Continuing Education
R.N., Children's Hospital, 1941; A.B., Bos-

*Stevens, Robert A.
Program Specialist, 4-H
B.S., University of New Hampshire, 1937.
Appointed 1955.

*Stewart, Edwina P.
Extension Home Economist,
Grafton County
B.S., Farmington State Teachers College,

*Stimson, Ruth G.
Extension Home Economist,
Rockingham County
B.S., University of New Hampshire, 1940;
*Stocking, Marion I.
Extension Home Economist,
Carroll County
Appointed 1958.

Suri, Amar N.
Research Associate in Space Science

Swift, David R.
Chemist, Center for Industrial and Institutional Development

*Szymujko, Joseph A.
Forester, Sullivan County

Talbot, Margaret L.
Chemist, Center for Institutional and Industrial Development

*Thomney, Sarah L.
County 4-H Development Agent,
Hillsboro County

*Upham, Edward F.
Agricultural Agent, Rockingham County

*Vashaw, Lois J.
Extension Home Economist,
Coos County

Votaw, V. Alastair
Staff Associate, Center for Institutional and Industrial Development

Walke, Raymond H.
Plant Scientist

†Whittaker, Donald A.
Poultry Farm Superintendent

Williams, Charles H.
Extension Area Agent, Ornaments

Wolfe, Allan
Research Associate, Space Science Center

*Wood, Dorothy A.
Extension Home Economist,
Hillsboro County

*Wyman, Christine C.
4-H Youth Development Agent,
Strafford County
Administrative Divisions

Academic Affairs
David W. Ellis, Vice Provost

Academic Computing Activities
Jerry A. Warren, Director

Administrative and Computational Services
Roderick R. Ricard, Jr., Director

Admissions
Eugene A. Savage, Director

Affirmative Action
Lolita M. Trotter, Director

Alumni Relations

Auxiliary Enterprises
Montgomery Childs, Director

Bookstore
Robert B. Stevenson, Manager

Budget and Administration
Allan B. Prince, Vice Provost
Ronald Olmstead, Budget Officer

Business Office
Ralph G. Smallidge, Controller

Career Planning and Placement Service
Edward J. Doherty, Director

Center for Educational Field Services
Jason E. Boynton, Director

Center for Emergency Planning and Operations
E. Warren Clarke, Coordinator

Center for Industrial and Institutional Development
Donald A. Moore, Director

Chaplains
Rev. Lawrence Rouillard, Campus Minister
Rev. Edward W. Meury, Rev. Charles N. Gross, Protestant, Durham Community Church
Rev. Paul F. McHugh, Catholic Chaplain, Pastor, St. Thomas More, Roman Catholic Church

Rev. Albert W. Snow, Rector, St. George's, Episcopal Church

Continuing Education, Division of
Edward J. Durnall, Director

Cooperative Extension Service
Maynard C. Heckel, Director

Counseling and Testing Center
Robert G. Congdon, Director

Cultural Events
Raymond E. Matheson, Director

Development
J. R. Sandberg, Director

Dining Services
Jane E. Griswold, Director

Educational Research and Testing Services
Jason E. Boynton, Acting Director

Engineering Design and Analysis Laboratory
Godfrey H. Savage, Director

Financial Aid
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Harriet B. Nason, R.N., Supervisor of Nursing

Health Studies, School of
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Raymond E. Matheson, Director

Institutional Research and Planning
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Arthur C. Mathieson, Director
Liberal Arts, College of
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Donald E. Vincent, Librarian

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College of
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E. Eugene Allmendinger,
Executive Officer

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Memorial Union
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Associate Director

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C. Robert Keesey

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Vincent E. Todd, Director

President’s Office
Thomas N. Bonner, President

Physical Plant Operation
Eugene H. Leaver, Director

Provost
Eugene S. Mills

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L. Franklin Heald, University Editor

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Richard Mayhew, Radiation Safety Officer

Registration and Records
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Administration
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David Bianco, Director

Water Resources Research Center
Gordon L. Byers, Chairman

Whittemore School of Business
and Economics
Jan E. Clee, Dean
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* Graduate Curricula and Associate Degree Curricula should not be confused with any particular "college" column, they are separate entries.
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