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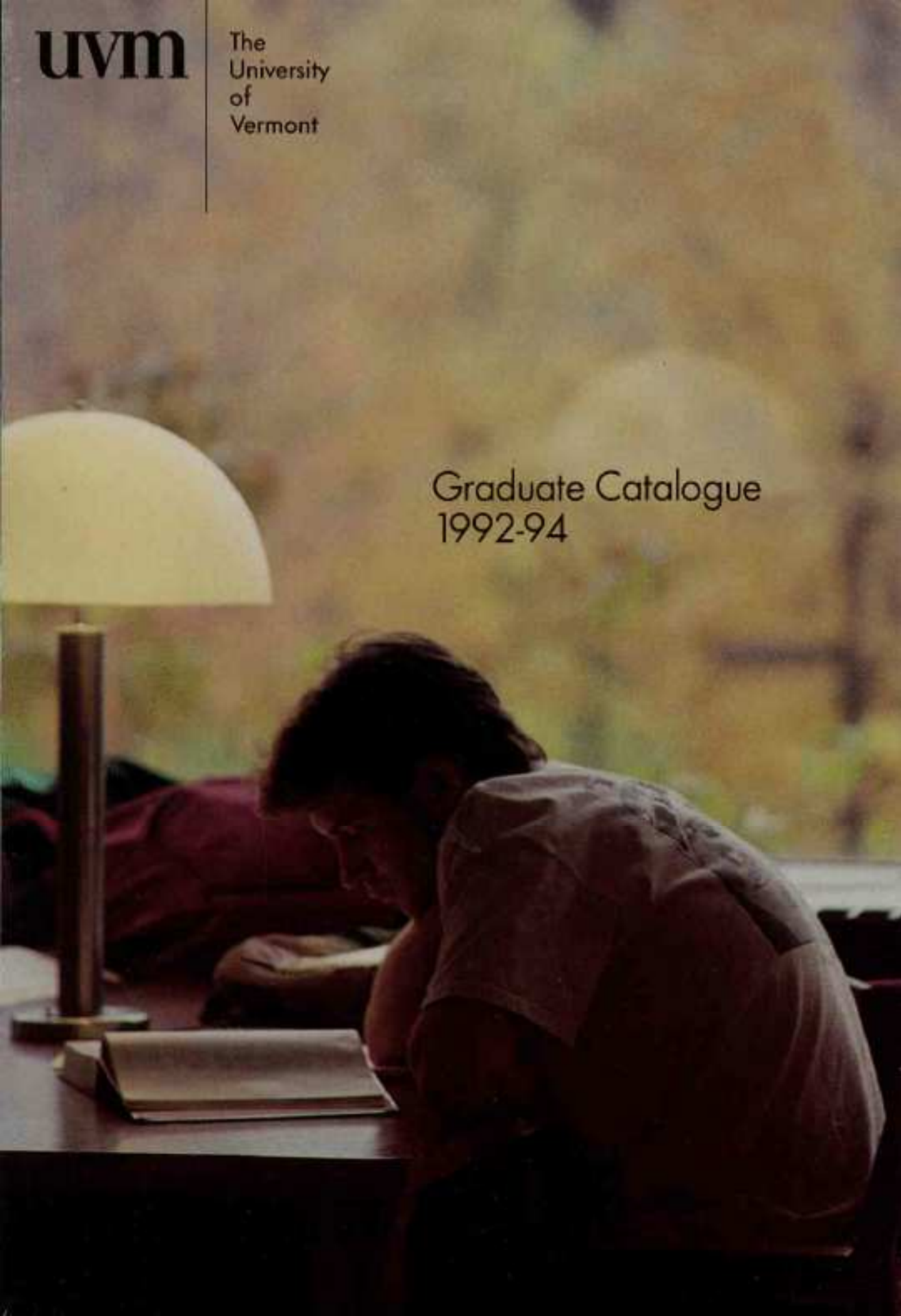
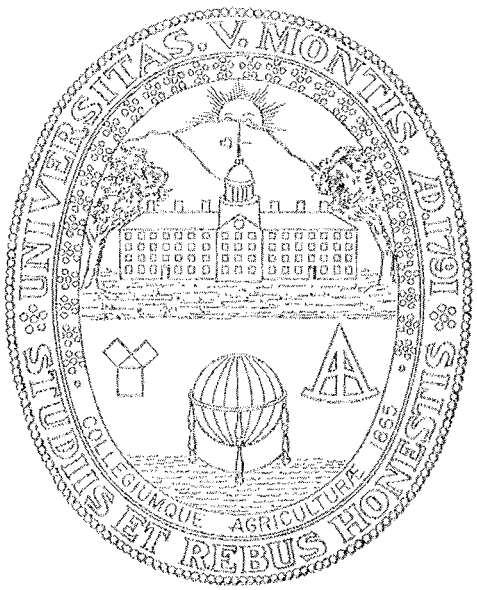
The
University
of
Vermont

Graduate Catalogue 1992-94





Graduate Catalogue 1992–94

The University of Vermont
Burlington, Vermont

Table of Contents

Notice of Nondiscrimination

Applicants for admission and employment, students, employees, sources of referral of applicants for admission and employment, and all unions or professional organizations holding collective bargaining or professional agreements with The University of Vermont are hereby notified that The University of Vermont does not discriminate on the basis of race, sex, sexual orientation, handicap, color, religion, age, national origin, or Vietnam Veteran status in admission or access to, or treatment or employment in, its programs and activities. In addition, it is the policy of the University that sexual harassment is unacceptable and will not be tolerated.

It is therefore the intent of the University to comply with the spirit and the letter of Titles VI and VII of the Civil Rights Act of 1964; Title IX of the Education Amendments of 1972; the Equal Pay Act of 1963; the Age Discrimination Act of 1975, Section 504 of the Rehabilitation Act of 1973; the Americans with Disabilities Act of 1990; the Vermont Fair Employment Practices Act; and such other federal, state, and local non-discrimination laws as may apply.

Inquiries or complaints concerning the University's compliance with the regulations implementing the above-referenced laws, or the affirmative action policies of the University should be made to The University of Vermont Director, Office of Affirmative Action, Equal Opportunity and Diversity Programs, Waterman Building, Burlington, Vermont 05405-0160, telephone (802) 656-3368; or the Office of the Vermont Attorney General, Pavilion Building, Montpelier, Vermont 05602, telephone (802) 828-3171. Inquiries or complaints concerning the University's compliance with the regulations implementing Title VI of the Civil Rights Act of 1964, 34 CFR Part 100; Title IX of the Education Amendments, 34 CFR Part 106; the Age Discrimination Act of 1975, 45 CFR Part 90; or Section 504 of the Rehabilitation Act of 1973, 34 CFR Part 104, may also be made to the Assistant Secretary for Civil Rights, United States Department of Education, Washington, DC 20202, or to the Director, United States Department of Education, Office of Civil Rights, Region I, J.W. McCormack POCH, Boston, MA 02109.

Correspondence

Please address all inquiries and correspondence concerning applications and admission to the Graduate College Admissions Office, The University of Vermont, Burlington, Vermont 05405-0160; telephone (802) 656-2699. For other matters concerning the Dean, telephone (802) 656-3160; FAX (802) 656-8429.

Please address requests for transcripts from The University of Vermont to the Registrar, The University of Vermont, Burlington, Vermont 05405-0160.

Please address requests for Summer Session and Evening Division information to the Office of Continuing Education, The University of Vermont, Burlington, Vermont 05405-3525; telephone (802) 656-2085.

Students at The University of Vermont are responsible for knowing and complying with all requirements for their respective degrees as stated in the catalogue.

The University of Vermont reserves the right to make changes in the course offerings, degree requirements, charges, and regulations and procedures contained herein as educational and financial considerations require, subject to and consistent with established procedures and authorizations for making such changes.

Although its legal title is The University of Vermont and State Agricultural College, the University is known to its students and alumni as UVM. This popular abbreviation is derived from the Latin Universitas Viridis Montis, *University of the Green Mountains.*

The colors of the University are Green and Gold.

Academic Calendars

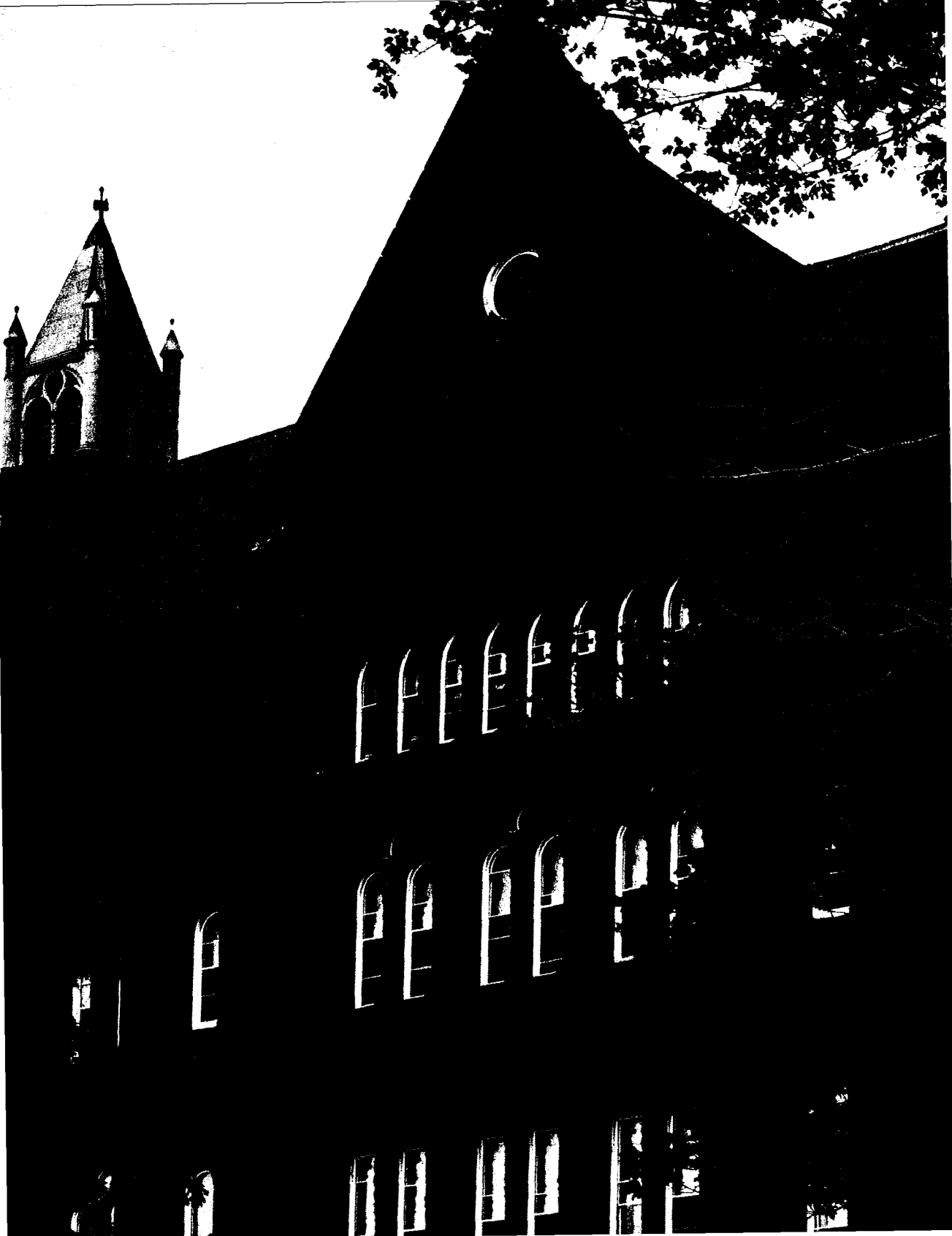
FALL 1992		
Registration	August 31	Monday
Classes begin	September 1	Tuesday
Labor Day holiday	September 7	Monday
Fall recess	October 16	Friday
Preregistration	November 18–20	Wednesday-Friday
Thanksgiving recess	November 25–27	Wednesday-Friday
Classes end	December 9	Wednesday
Reading and exam period	December 10–18	
Reading days	December 10, 12, 13, 16	
Exam days	December 11, 14, 15, 17, 18	
SPRING 1993		
Martin Luther King holiday	January 18	Monday
Registration	January 19	Tuesday
Classes begin	January 20	Wednesday
President's Day holiday	February 15	Monday
Town Meeting recess	March 2	Tuesday
Spring recess	March 22–26	Monday-Friday
Preregistration	April 21–23	Wednesday-Friday
Honors Day	April 26	Monday (no classes after 3:00 p.m.)
Classes end	May 5	Wednesday
Reading and exam period	May 6–14	
Reading days	May 6, 8, 9, 12	
Exam days	May 7, 10, 11, 13, 14	
Hooding Ceremony	May 21	Friday
Commencement	May 22	Saturday
FALL 1993		
Registration	August 30	Monday
Classes begin	August 31	Tuesday
Labor Day holiday	September 6	Monday
Fall recess	October 15	Friday
Preregistration	November 17–19	Wednesday-Friday
Thanksgiving recess	November 24–26	Wednesday-Friday
Classes end	December 8	Wednesday
Reading and exam period	December 9–17	
Reading days	December 9, 11, 12, 15	
Exam days	December 10, 13, 14, 16, 17	
SPRING 1994		
Martin Luther King holiday	January 17	Monday
Registration	January 18	Tuesday
Classes begin	January 19	Wednesday
President's Day holiday	February 21	Monday
Town Meeting recess	March 1	Tuesday
Spring recess	March 21–25	Monday-Friday
Preregistration	April 20–22	Wednesday-Friday
Honors Day	April 25	Monday
Classes end	May 4	Wednesday
Reading and exam period	May 5–13	
Reading days	May 5, 7, 8, 11	
Exam days	May 6, 9, 10, 12, 13	
Hooding Ceremony	May 20	Friday
Commencement	May 21	Saturday

FALL 1994

Registration	August 29	Monday
Classes begin	August 30	Tuesday
Labor Day holiday	September 5	Monday
Fall recess	October 21	Friday
Preregistration	November 16–18	Wednesday-Friday
Thanksgiving recess	November 23–25	Wednesday-Friday
Classes end	December 7	Wednesday
Reading and exam period	December 8–16	
Reading days	December 8, 10, 11, 14	
Exam days	December 9, 12, 13, 15, 16	

SPRING 1995

Martin Luther King holiday	January 16	Monday
Registration	January 17	Tuesday
Classes begin	January 18	Wednesday
President's Day holiday	February 20	Monday
Town Meeting recess	March 7	Tuesday
Spring recess	March 20–24	Monday-Friday
Preregistration	April 19–21	Wednesday-Friday
Honors Day	April 24	Monday
Classes end	May 3	Wednesday
Reading and exam period	May 4–12	
Reading days	May 4, 6, 7, 10	
Exam days	May 5, 8, 9, 11, 12	
Hooding Ceremony	May 19	Friday
Commencement	May 20	Saturday



The University of Vermont

THE UNIVERSITY OF VERMONT AND BURLINGTON COMMUNITY

The University of Vermont was founded in 1791, taking its place among the handful of colleges founded in this country in the eighteenth century for the higher education of young colonials and Americans of the first postrevolutionary generation. The University was the fifth New England college chartered, the second established by a state to grant the bachelor's degree, and the twentieth in the nation to do so.

The University of Vermont was the first college or university in the country to have it plainly declared in its charter that the "rules, regulations, and by-laws shall not tend to give preference to any religious sect or denomination whatsoever" — a clear assertion of Vermont's commitment to equality and enlightenment.

The University pioneered in yet another area of society, that of giving women equal status with men in higher education. In 1871, the University defied custom and admitted two women as students and four years later was the first institution in the country to admit women to full membership in the scholarly society, Phi Beta Kappa.

Though it has enjoyed a long tradition of substantial private support, University development has been identified closely with that of the State since 1791 when Vermont's founding General Assembly granted a charter to the University and set aside about 29,000 acres throughout the State with the intent that rents from this land would support the new educational institution. The same Vermont General Assembly established that the bylaws of the University should give no preference to any religious sect or denomination or discriminate against any, making The University of Vermont the first in this country to go on public record as supporting freedom of religion upon its campus.

The University of Vermont consists of the Colleges of Agriculture and Life Sciences, Arts and Sciences, Engineering and Mathematics, Education and Social Services, Medicine, and the Graduate College; the Schools of Allied Health Sciences, Business Administration, Natural Resources, and Nursing; and Continuing Education.

With a population of about 38,000, Burlington is Vermont's largest city. The greater Burlington area of approximately 125,000 inhabitants is divided between pleasant suburbs and picturesque farms and woodland. Burlington enjoys magnificent views of Lake Champlain and the Adirondack Mountains to the west and Vermont's Green Mountains to the east. Easily available outdoor activities include swimming, boating, hiking, climbing, and skiing.

Some 200 miles northwest of Boston, 300 miles north of New York City, and about 100 miles south of Montreal, Burlington is served by major airlines, buses, and Amtrak, and is contiguous to Vermont's interstate highway system.

THE GRADUATE COLLEGE

The Graduate College of The University of Vermont is responsible for all advanced degree programs except the program leading to the degree of Doctor of Medicine. Thus, the College serves all persons seeking advanced and comprehensive knowledge of the scholarship and research in a particular field of study beyond the baccalaureate degree.

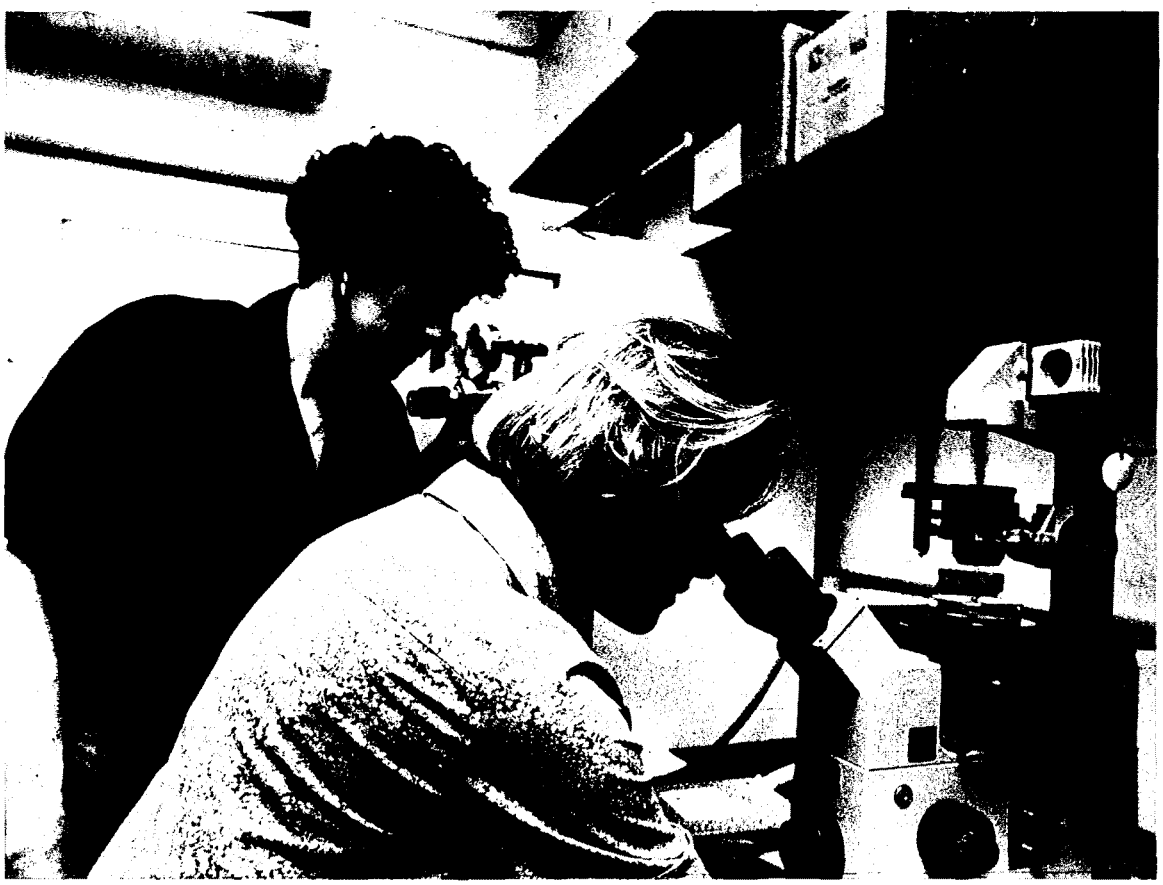
Although the Graduate College was established formally in 1952 under a full-time Dean, the University recognized early the value of graduate education and awarded its first master's degree in 1807. Today, the Graduate College offers 72 different master's programs of study and 19 doctoral programs. During the 1991-92 academic year, 309 master's and 47 doctoral degrees were awarded.

The Graduate College is served by an Executive Committee composed of ten faculty and a graduate student member. The Executive Committee works closely with the Dean of the Graduate College to insure comprehensive and outstanding programs of study. Currently, the College enrolls approximately 1,200 students, with about 350 of these pursuing the doctorate.

A variety of scholarships, fellowships, assistantships, and special loan programs are available in modest number to students with solid and sustained records of academic performance. The combination of sound library holdings, laboratories, and computer facilities, along with the engaging size of the University, affords a unique opportunity to pursue high quality graduate programs in a challenging yet personable environment.

THE UNIVERSITY SCHOLARS

The University Scholar Awards program was established by the Graduate College to recognize outstanding and sustained contributions of University faculty to research and scholarship in their disciplines. Each year, four faculty members are selected for this award.



For the academic year 1992-93, the University Scholars are Abbas Alnasrawi (Economics), Kenneth I. Golden (Electrical Engineering and Mathematics), Robert J. Johnson (Orthopaedics and Rehabilitation), and Esther D. Rothblum (Psychology).

The University Scholars for the previous five years are:

Thomas M. Achenbach (Psychiatry and Psychology)
Richard L. Anderson (Electrical Engineering)
Heinz L. Ansbacher (Emeritus, Psychology)
C. Hackett Bushweller (Chemistry)
Lyndon B. Carew, Jr. (Animal Sciences)
Raymond T. Coward (Special Education, Social Work, and Social Services)
Paula Fives-Taylor (Microbiology and Molecular Genetics)
Samuel B. Hand (History)
Chad D. Hansen (Philosophy)
William A. Haviland (Anthropology)
Raul Hilberg (Political Science)
A. Paul Krapcho (Chemistry)
Jerold F. Lucey (Pediatrics)
Kenneth G. Mann (Biochemistry)
John J. McCormack (Pharmacology)
R. Harry Orth (English)
Rodney L. Parsons (Anatomy and Neurobiology and Physiology and Biophysics)
Malcolm H. Pope (Orthopaedics and Rehabilitation and Mechanical Engineering)
George A. Sher (Philosophy)
Judith L. Van Houten (Zoology)

RESOURCES FOR RESEARCH AND SCHOLARSHIP, AND CULTURAL ACTIVITIES

The University Libraries and Media Services. The Bailey-Howe Library holds the largest book collection in Vermont, and acquires regularly major periodicals, scholarly journals, and indexing and abstracting services. The University collections also include books in medicine and health-related sciences, and a strong collection in medical periodical literature maintained in the Dana Medical Library of the Division of Health Sciences.

The Bailey-Howe Library is a depository for United States and Canadian government publications, and acquires newspapers, pamphlets, maps, and materials in microfilm. The Special Collections Department includes books and manuscripts from the library of George P. Marsh, and a significant Masefield poetry collection; its Wilbur Collection is rich in books and manuscripts of those associated with the State, including Ira Allen, Henry Stevens, Dorothy Canfield, Vermont Governors, and members of the State Congressional delegation.

The Chemistry and Physics Library is located in the Clinton D. Cook Physical Sciences Building.

The University Archives in the Waterman Building contain the permanent official records of the University.

The University Computing Center. The University Computing Center provides computing facilities for the campus community. The Center includes a DEC 4000 running VAX/VMS, an IBM 4381 running VM/CMS, an RS 6000 running UNIX and microcomputer labs servicing the computation needs of the varied research projects on campus. Its facilities are also used as an integral part of many graduate and undergraduate courses.

The staff of the Computing Center is available to anyone who requires assistance with the use of the terminals or programming. A large up-to-date program library is maintained by the Center for use by University personnel.

The Robert Hull Fleming Museum. The Museum houses a notable University collection of Western and non-Western art, and is a center for research and museological studies as well as a place for aesthetic exploration. The Reed Collection of Plains Indian Art and the Schnackenberg Collection of 19th and 20th-century American Art, for example, are outstanding and of particular interest to students of American art and history. Exhibits are frequently rotated to serve class and seminar needs. Two galleries are given to changing exhibitions on special topics. These are frequently augmented by lectures, gallery talks, and films. Besides facilities to support the scholarly use of the collections, the Museum also houses class and seminar rooms for art history courses and the Art Department slide library of 40,000 slides.

Sponsored and Institutional Research. The University received over $38 million exclusively for sponsored research funding during fiscal year 1991, and ranks nationally as one of the 100 leading universities in terms of sponsored research support. In addition, there are a substantial number of faculty research projects supported, in part, by institutional research committees. Graduate students frequently serve as integral parts of faculty research projects which span a wide range of disciplines.

The George Aiken Lectures. The annual George Aiken Lectures, established in honor of Vermont's dean of the United States Senate, focus on issues of national and international importance. They bring together speakers of prominence, University faculty, and the University community to achieve greater understanding of significant human concerns.

The Vermont Seminars. The Vermont Seminars program augments the focus of teaching and research at the University and enriches educational offerings by bringing to campus individuals from a variety of walks of life, including faculty, statespersons, distinguished citizens, and leaders in special fields.

The George Bishop Lane Artists' Series. The George Bishop Lane Artists' Series is one of the largest collegiate artists series in the country. It was inaugurated in 1955 by a gift of over $300,000 from the late Mrs. Lane, in honor of her husband, George Bishop Lane of the Class of 1883.

The Lane Series allows the University to bring annually to the campus and the Burlington area a continuing program of outstanding musical, theatrical, dance, and other artistic productions for a moderate admissions fee. The Series is planned and produced by an advisory committee comprised of faculty, students, and townspeople.

Graduate Teaching Award. Annually, each graduate department and program is given the opportunity to nominate a graduate student who is particularly outstanding as a teaching fellow. A committee in the Graduate College reviews the nominations, and at a special reception all of the nominees are publicly recognized and a special commendation is awarded to the nominee judged most outstanding.

Graduate College Research Day. In the spring each year, the Graduate College recognizes formally the research undertaken by graduate students. A full day is devoted to talks and poster presentations by students from all of the disciplines. The entire University community has the opportunity to see and hear about the high quality research that graduate students conduct.

The Degree Programs of the Graduate College

The Graduate College offers the following degree programs:

MASTER OF ARTS

- English
- French
- Geography
- German
- Greek and Latin
- History
- Political Science
- Psychology

MASTER OF SCIENCE

- Agricultural Biochemistry
- Agricultural and Resource Economics
- Animal Sciences
- Biochemistry
- Biomedical Engineering
- Biostatistics
- Botany
- Cell and Molecular Biology
- Chemistry
- Civil Engineering
- Communication Science and Disorders
- Computer Science
- Counseling
- Electrical Engineering
- Engineering Physics
- Forestry
- Geology
- Historic Preservation
- Materials Science
- Mathematics
- Mechanical Engineering
- Medical Technology
- Microbiology and Molecular Genetics
- Natural Resource Planning
- Nursing
- Nutritional Sciences
- Pathology
- Pharmacology
- Physics
- Physiology and Biophysics
- Plant and Soil Science
- Statistics
- Water Resources
- Wildlife and Fisheries Biology
- Zoology

MASTER OF BUSINESS ADMINISTRATION

MASTER OF PUBLIC ADMINISTRATION

MASTER OF SOCIAL WORK

MASTER OF EDUCATION

- Administration and Planning
- Curriculum and Instruction
- Educational Studies
- Higher Education and Student Affairs
- Interdisciplinary Major (Self-Designed)
- Occupational and Practical Arts
- Reading and Language Arts
- Special Education

MASTER OF ARTS IN TEACHING

- Botany
- Chemistry
- English
- French
- Geography
- Geology
- German
- Greek and Latin
- History
- Mathematics
- Occupational and Practical Arts
- Physics
- Zoology

MASTER OF SCIENCE FOR TEACHERS

- Biology (Botany and Zoology)
- Geology
- Mathematics
- Physical Sciences (Chemistry and Physics)

MASTER OF EXTENSION EDUCATION

- Agricultural Agencies and Organizations
- Business and Industry
- Youth Organizations

DOCTOR OF EDUCATION

- Educational Administration

DOCTOR OF PHILOSOPHY

- Agricultural Biochemistry
- Anatomy and Neurobiology
- Animal Sciences
- Biochemistry
- Botany
- Cell and Molecular Biology
- Chemistry
- Civil Engineering
- Electrical Engineering
- Materials Science
- Mathematical Sciences
- Mechanical Engineering
- Microbiology and Molecular Genetics
- Pharmacology
- Physiology and Biophysics
- Plant and Soil Science
- Psychology
- Zoology

CONCURRENT DEGREE PROGRAMS: M.D./M.S. AND M.D./Ph.D.

Postsophomore fellows in medicine who have been accepted into a Graduate College program are permitted to apply credit from appropriate medical courses in which a letter grade of A, B, or C is earned toward a M.S. or a Ph.D. degree. Such students are enrolled in the Graduate College for one or more years to pursue research and enroll in those courses that normally are not included within their medical program of study. While such persons are working toward both an M.D. and M.S. or Ph.D., completion of each degree need not occur at the same time.

Policies of the Graduate College

APPLICATION POLICIES, DEADLINES, AND PROCEDURES

Eligibility. To be eligible for admission to any program, applicants must hold a U.S. baccalaureate degree earned prior to the date of first graduate enrollment at The University of Vermont or have completed an academic program judged the equivalent by the Graduate College. If the degree is from an unaccredited institution, students must submit both general and advanced subject GRE scores. Individual degree programs may have additional requirements as described in the program listings in the back section of this catalogue.

Applicants are expected to be fluent in English; instruction at The University of Vermont is conducted in English. There is no intensive English as a second language program at the University, although limited instruction is available to enhance speaking fluency in English.

Application and Financial Aid Deadlines

Admission. It is in the applicant's best interest to make sure that application materials are filed well in advance of deadlines. Some programs can accommodate only a limited number of new graduate students each year.

April 1 is the application deadline for fall enrollment in all programs, except the following:

Psychology	February 1
Communication Science and Disorders	March 1
Counseling	March 1
Historic Preservation	March 1

Although some programs are willing to review late applications, we urge you to contact specific programs before filing a late application. Occasionally a program accepts applications for January admission. Please contact the appropriate program regarding its policy on spring admissions.

Financial Aid. *The deadline for all students seeking financial aid in the form of fellowships or assistantships is March 1, except Psychology, which is February 1.* For information regarding the types of financial aid available, consult "Fellowships, Assistantships, Traineeships, Stipends, and Grants," page 27 and "Financial Aid," page 29.

Admission Procedure for Full- or Part-Time Students

Degree Students. Application forms are included in the *Prospectus* available from the Graduate Admissions Office, 332 Waterman Building, The University of Vermont, Burlington, VT 05405-0160.

Applicants who are U.S. citizens must submit the following material:

a. The original and two copies of the completed application form and the statement of purpose;

b. Scores from appropriate standard graduate admission test(s) *taken within five years of the date of application. Test scores are required for any applicant seeking financial aid in the form of a fellowship or assistantship.* For additional information, see "Graduate Admission Tests" below and consult the program listing in which you are interested.

c. Two official transcripts from each college or university attended. UVM students should request the Registrar to send their transcripts to the Graduate College Admissions Office;

d. Letters of recommendation from three persons qualified to assess your potential for graduate work. College or university placement files are accepted provided that they are forwarded directly from the placement office. Photocopied references are acceptable only with original signatures; FAX references are not acceptable;

e. A $25 nonrefundable application fee.

International applicants must submit the following material:

a. The original and two copies of the completed application form and the statement of purpose;

b. Scores from appropriate standard graduate admission test(s) *taken within five years of the date of application. Test scores are required for all applicants seeking financial aid in the form of a fellowship or assistantship.* For additional information, see "Graduate Admission Tests" below.

c. Scores from the Test of English as a Second Language (TOEFL) if your native language is not English or formal education has been conducted in another language. A score of at least 550 is required for admission; generally, a minimum score of 600 is required for any applicant seeking fellowships or assistantships. Information about the TOEFL examination is available from the Educational Testing Service, Box 6144, Princeton, N.J. 08541-6155, U.S.A.

d. Two official transcripts from each college or university attended and, if necessary, an English translation of the transcripts;

e. Letters of recommendation from three persons qualified to assess your potential for graduate work. College or university placement files are accepted provided that they are forwarded directly from the placement office. Photocopied references are accept-

able only with original signatures; FAX references are not acceptable;

f. A $25 nonrefundable application fee; in U.S. dollars, by check or money order made payable to The University of Vermont;

g. For purposes of obtaining a visa, the United States Immigration and Naturalization Service requires that all international students submit evidence of independent financial support in the form of a signed statement from a bank or scholarship source. Appropriate forms will be sent with the application materials.

Application Review Process. As soon as an application is received in the Graduate College Admissions Office, a file is set up to collect all the material. Copies of the application form and the statement of purpose are forwarded immediately to the appropriate program. Programs, however, do not act upon an application until the file is complete with test scores, transcripts, and letters of recommendation.

Committees in each program review applications carefully. The statement of purpose is extremely important, as are test scores and past academic performance. Letters of support are weighed carefully. Programs must also consider external factors, such as the number of spaces they can make available to new applicants.

Recommendations to admit or not admit, to provide financial aid or not, are made by the programs and forwarded to the Graduate College where they are reviewed. Letters of acceptance or denial are sent from the Graduate College. Offers of financial support are made directly by programs to the applicants.

If you do not hear anything regarding your application after a sufficient amount of time, you may call the Graduate College Admissions Office (802/656-2699) and request a status report on your application. Questions about admission to individual programs should be directed to the appropriate program.

All documents received in support of an application, except those foreign ones considered irreplaceable or term paper and essays required by some departments, become the property of the Graduate College and cannot be returned, copied, or transferred.

It is the applicant's responsibility to ensure that all supporting materials for an application are received by the deadline.

Acceptance and Candidacy for Advanced Degrees. Applicants for the master's degree may be admitted to graduate studies or accepted to candidacy for the degree concurrent with admission. Acceptance to candidacy for the master's degree is granted only to those students who have met fully all undergraduate course prerequisites required for the graduate degree program and all departmental requirements for candidacy (e.g. course work, examinations, professional certification where applicable). The approval of the department and the Dean is required for concurrent admission and acceptance to candidacy.

Candidacy for the doctoral degree requires a full year of graduate study in residence at The University of Vermont. Most programs require satisfactory completion of a qualifying examination. A doctoral student is accepted to candidacy upon the approval of the student's Studies Committee, the department or departments concerned, and the Dean of the Graduate College.

Nondegree Students. Persons who have completed a baccalaureate degree and wish to take courses that do not carry graduate credit or wish to take courses for credit but do not seek a degree, do not need to make formal application to the Graduate College, but may take graduate level courses through Continuing Education. For more information, contact Continuing Education, 322 South Prospect Street, Burlington, VT 05405.

Nondegree students are limited to a maximum of six course credit hours per semester unless additional enrollment is approved by the Dean of the Graduate College. A nondegree student who has accumulated nine credit hours of graduate course work at the University must seek approval for further enrollment from the Dean of the Graduate College.

GRADUATE ADMISSION TESTS

Information about these tests is available from most college testing centers or from Graduate Record Examinations, Educational Testing Service, Box 6000, Princeton, N.J. 08541-6000. Those considering application to a graduate program should remember that it often takes four to six weeks for the Graduate College to receive the results of test scores.

Most graduate programs require applicants to submit graduate admission test scores, such as the GRE (Graduate Record Examination) or the GMAT (Graduate Management Admission Test). *Applicants should consult the listing of the program to which they are applying to determine exactly which test scores are required. Scores which are submitted should be from tests taken within five years of the date of application. Every student who is seeking financial aid in the form of an assistantship or fellowship is required to submit GRE or GMAT scores from tests taken within five years of the date of application.*

ENROLLMENT POLICIES AND PROCEDURES

Health Record. The University requires that all students file a personal health and immunization record with the Student Health Service at the time of first enrollment. Appropriate forms are sent with registration material. They are also available at the Student Health Center, 425 Pearl Street.

Registration. Consult the Academic Calendar printed in the front of this catalogue for registration dates. Students register for courses at the time and in the manner designated by the University Registrar. Each semester course lists are published by the Registrar's Office. Enrollment forms for new graduate students are available in the Graduate College Admissions Office. Preregistration is encouraged for presently enrolled graduate students.

Before enrolling in courses, students must consult with their program advisor and obtain required sig-

natures before submitting their course enrollment forms to the Registrar. All charges for the ensuing semester must be paid, or otherwise provided for, before registration is completed.

Graduate Course Levels. Courses which may apply towards a graduate program are generally numbered 200 and above. Courses numbered 400 or above are limited to candidates for the degree of Doctor of Philosophy; courses numbered 300 to 399 are limited to graduate students unless special permission is given by the appropriate department or program. Please consult individual programs for possible exceptions.

Course Loads. Normally, full-time nonfunded graduate students enroll for nine to 12 hours per semester; full-time funded students, six to ten hours. Maximum enrollment is 15 hours per semester, and 9 hours summer. Enrollment in excess of the normal full-time course load requires written approval from your advisor and the Dean of the Graduate College.

Auditing Classes. Courses may be taken for audit; however, tuition for the credit hours is charged as usual. Under no circumstances will graduate credit or a grade be allowed for audited courses. A student wishing to audit a course must meet minimum levels of performance set by the instructor at the time of registration in order to receive an audit grade on a transcript. Tuition scholarships funded by the Graduate College do not cover tuition for audited courses.

Physical Education Classes. Students may not enroll in physical education classes without prior approval by the Dean of the Graduate College. Graduate College tuition scholarships do not cover any fees for physical education activities.

Credit by Examination. A student may, under certain circumstances, receive credit for a course by taking an examination. A fee of $35 per credit is charged for each examination. Any credit earned by examination applies to the total number of credit hours allowed for validation and transfer (See "Transfer or Validation of Previous Credit," page 19). Appropriate forms to initiate the process of credit by examination are available in the Registrar's Office.

Drop/Add. Courses may be added or dropped only during the first two weeks of classes. Appropriate drop/add forms are available from the program or the Registrar's Office. After the first week of classes an instructor may refuse admission to a course if certain material (such as laboratories) cannot be made up and the loss of this work seriously affects the quality of the educational experience of the student seeking to enter the course. Faculty are not required to give make-up examinations, papers, or quizzes. No drops are allowed after the second week of classes except in cases where a student is enrolled by administrative error and as a result has not attended the course. The disposition of such a case is handled by the Registrar's Office.

Withdrawal from Courses. Between the end of the second week to the end of the ninth week of classes, withdrawal requires a student to complete a Course Withdrawal form, available from the Registrar's Office. Withdrawal forms must include the signatures of the student's advisor and course instructor. The instructor sends the form to the Registrar's Office. The instructor also records the withdrawal grade on the final grade sheet which is sent to the Registrar at the end of the semester.

Between the ninth week and the last day of classes, withdrawal requires students to petition the Dean of the Graduate College explaining that they are unable to continue in the course due to circumstances beyond their control. Such a petition must contain conclusive evidence, properly documented, of the situation which prevents the completion of the course. Acceptable reasons do not include dissatisfaction with performance in a course or with an expected grade, with the course or the instructor, or the desire to change a major or program. If the petition is approved, the withdrawal procedure follows that process described above.

Undergraduate Enrollment for Graduate Credit. UVM senior undergraduates may enroll for graduate credit at UVM under the following circumstances: the course must be available for graduate credit; total enrollment including the graduate course must not exceed 12 credit hours in the semester in which the course is taken; the course must not be computed as part of the bachelor's degree; permission to seek such graduate credit must be requested of the Dean of the Graduate College in writing by the Dean of the undergraduate college or school prior to enrollment for such credit. Such graduate credit is limited to six hours, and is not available for transfer to another institution as graduate credit. It can be used only at UVM if and when the student is admitted to a UVM graduate program and only if the course is judged appropriate by the student's advisor for the graduate program.

Grading Policies. Letter grades are used to indicate levels of performance in courses as follows: A, excellent; B, good; C, fair; F, failure. Designations of S, satisfactory, and U, unsatisfactory, are used to indicate levels of performance for credits received in Thesis or Dissertation Research and may be used to indicate levels of performance in a Seminar. There are no quality points associated with the letter grades of S and U.

A candidate for a graduate degree must complete the program with a minimum overall grade-point average of 3.00. For the purpose of determining a grade-point average, the following applies: A+, 4.00; A, 4.00; A-, 3.67; B+, 3.33; B, 3.00; B-, 2.67; C+, 2.33; C, 2.00; C-, 1.67; F, 0.00. A course may be repeated for credit only when failed and only once; only the second grade is then considered. Both grades remain on the student's transcript.

A student may be dismissed from the Graduate College if two grades or more below a B (3.00), or the designation of U in Thesis or Dissertation Research or Seminar are received.

The designation *"Inc"* or *"I"* applies to work of acceptable quality when the full amount is not completed because of illness or emergency. It can be awarded only with the prior permission of the Dean of the Graduate College. The Dean may set the limit

of time when the work of the course is to be completed. In no case shall this time be set longer than the beginning of the corresponding semester of the next academic year.

The grade of XC *(Extended Course)* is awarded at the end of the semester to a student who is enrolled in an identified course the nature of which makes it unreasonable or impossible for the student to complete the required work within the regular semester.

Students who withdraw from a course after the date prescribed by the Registrar will receive the grade of W – withdrawn. The grade W does not enter into the grade-point average (GPA).

Graduate students may elect to take an undergraduate course on a satisfactory (S) – unsatisfactory (U) basis provided permission is obtained, prior to enrollment, from the department or program chairperson and the Dean of the Graduate College and a letter grade is not required by the Studies Committee for purposes of evaluation. Courses at the 200 level or above other than Seminar or Thesis/Dissertation Research may not be taken on a satisfactory (S) – unsatisfactory (U) basis for graduate credit.

A grade, other than Inc/I or XC, may be changed only if there was an error in its calculation. In cases in which a student requests reconsideration of a grade for a course already taken, the grade change, if any, must be made by the instructor and approved by the Dean by the end of the first month of the following semester unless an extension has been granted by the Dean within the first month of the following semester.

Dismissal. Students whose academic progress is deemed unsatisfactory at any time may be dismissed from the Graduate College by the Dean upon consultation with the student's department or program. In addition, students may be dismissed if (a) they receive two grades or more below a B (3.00), or (b) they receive a U (Unsatisfactory) on their Thesis or Dissertation Research or Seminar.

CHANGE OF PROGRAM

If a duly admitted student wishes to change to a different program offered at UVM, a request must be made in writing by the student to the Dean of the Graduate College. Upon receipt of the request, the student's file is forwarded to the Chairperson of the desired program for review. If both the faculty of the desired program and the Dean of the Graduate College approve, the formal transfer of program is made in the Graduate College Office with notification to the former program chairperson, new program chairperson, the student, and the Registrar. The time limit for completion of the degree runs from the date of matriculation in the new program, with credit brought in subject to the seven-year transfer limitation.

CONTINUOUS REGISTRATION

Students who have completed all credits required for a degree but have not completed all graduation requirements must enroll each semester for Continuous Registration (GRAD 900) and pay a $100 Continuous Registration fee each semester until all degree requirements, including removing incomplete grades, passing the comprehensive examination, or completing a thesis or dissertation, are completed.

LEAVE OF ABSENCE

A leave of absence suspends the time limit for degree completion for the duration of the leave. It does not suspend the time limit for the completion of individual courses.

Eligibility. Only students who have not enrolled for all course credit requirements may request a leave of absence. The maximum leave is one year. Students who have enrolled for all required credits but have not completed all degree requirements, such as passing the comprehensive examination or completing a thesis or dissertation, are not eligible for a leave of absence but must register for Continuous Registration.

Procedure. Students request a leave of absence from their program director or chairperson. If the program approves the request, the chairperson or director completes the Leave of Absence form available from the Graduate College Office and forwards it to the Dean for approval. A leave of absence does not take effect until after approval has been received from both the program chairperson or director and the Dean of the Graduate College.

Any student who does not enroll following termination of the leave of absence will be deactivated from the Graduate College.

DEACTIVATION AND REACTIVATION

Deactivation is equivalent to withdrawal from a graduate program. Students who do not enroll in their program following the termination of the leave of absence will be deactivated from the Graduate College by the Graduate Dean. Students who, prior to completing enrollment for all credit requirements for a graduate program, do not enroll for one or more credits for a period of one calendar year and are not on an approved leave of absence will be deactivated from the College by the Graduate Dean.

Reactivation into a program requires the approval of the program and a petition to the Graduate College. Students seeking reactivation must pay a $25 Reactivation fee and all other fees, including current and back Continuous Registration fees if applicable.

WITHDRAWAL FROM DEGREE PROGRAM

Students must notify the Graduate Dean's Office in writing of their intent to withdraw from a degree program. However, if a student does not register at The University of Vermont for course work, thesis or dissertation research, or continuous registration for a period of more than one calendar year, and does not notify the department or the Graduate Dean's

Office in writing, the student will be considered to have withdrawn from the degree program. It will be necessary to apply for reactivation and pay a reactivation fee if the student wishes to resume the graduate program.

TRANSFER OR VALIDATION OF PREVIOUS CREDIT

Graduate level course credit acquired at UVM may under certain circumstances be *validated* as part of a student's graduate program. Graduate level course credit earned at another institution may under certain circumstances be *transferred and credited* to a student's degree program. *The maximum number of validation credits, transfer credits, or credits earned by examination may not exceed a total of nine hours for a master's degree or 24 hours for a doctoral degree.* If credit is transferred or validated, only the credit is transferred, not the grade.

If an applicant is enrolled as a nondegree student in appropriate graduate courses under the advisement of the program during the semester in which the application is approved for admission, up to six hours of credit from that semester may be applied to the degree program. This credit will not reduce the number of validation or transfer credit hours available.

No credit acquired prior to formal admission to the Doctor in Education program may be applied toward degree requirements.

Credit cannot be transferred or validated for (1) courses taken prior to the completion of a baccalaureate degree; (2) courses which would not, if taken at The University of Vermont, receive graduate credit; (3) courses in which a grade lower than B (3.00) was received; (4) correspondence courses; (5) courses which are inappropriate for inclusion in any degree program offered by the Graduate College; (6) courses which were taken more than seven years prior to the date of completion of degree requirements for a master's program or nine years for a Ph.D. program; or (7) thesis or dissertation credits received at another university.

Forms to initiate the validation or transfer process are available in the Graduate College Office.

Concurrent Master's and Doctor of Philosophy Credit

Up to 24 hours of course work for which graduate credit is earned at UVM in a master's degree program, whether a master's degree is received or not, may be applied toward a Ph.D. at UVM provided they are appropriate for the Ph.D. program.

No provision is made for a person to employ the same credit to satisfy two master's degrees at The University of Vermont.

MAXIMUM TIME LIMITS FOR DEGREE COMPLETION

MASTER'S DEGREE	
Full-Time Student	3 years
Part-Time Student	5 years
DOCTORAL DEGREE	
All students	9 years

Individual departments may set deadlines within these time limits.

DEGREE REQUIREMENTS

General Requirements for the Master's Degree

In addition to the requirements described below, individual programs may have their own specific requirements. Students should read and familiarize themselves with their program's requirements. Some of them are detailed in this catalogue under individual program listings and other requirements are available from the director or chairperson of each program.

Credit Hours. Most master's degrees require a minimum of 30 hours of credit. Consult individual program descriptions for exceptions. In programs that require a thesis, the number of credit hours earned in thesis research may vary between six (minimum) and 15 (maximum) and is included as part of the 30-hour minimum. Consult individual programs for specific information. With the *prior* approval of their department and the Graduate College students may apply one 100-level, three-credit course towards their graduate program. A student's advisor must petition the Graduate College for approval *before* the student enrolls in the course. Consult individual programs for further limitations. Under no circumstances will a course numbered below 100 be applicable to a master's program.

Minimum Residence Requirements. Candidates for the master's degree must satisfactorily complete 21 hours in residence. The residency requirement is completed by courses that (1) are taken for graduate credit through The University of Vermont either in the academic year or summer on the main campus or at off-campus locations, and (2) are taken after the student has been admitted to the Graduate College. Some programs may require more than the above minimum hours in residence. Consult with the individual program.

Comprehensive Examination. All master's degree students are required to pass a written and/or oral comprehensive examination in their field of specialization. If both formats are used, satisfactory completion of the written examination is prerequisite to standing for the oral examination. All comprehensive examinations are to be taken on The University of Vermont campus in Burlington. One re-examination only is permitted for any comprehensive examination. *The comprehensive examination is not the same as an oral thesis defense and must be satisfactorily passed before defending the thesis.* Consult individual program descriptions for specific information.

When students plan to take their comprehensive examination they should enroll in GRAD 397: Master's Comprehensive Examination. There is no fee. A grade of "S" or "U" is recorded.

Thesis. Consult the program description to determine whether a thesis is required. If a thesis is required, the candidate for the master's degree undertakes a problem of original research under the supervision of a member of the Graduate College Faculty in the department of specialization. At the conclusion of the research, the student must present a thesis which embodies the results of the work and demonstrates the capability for independent research.

A thesis must be prepared and submitted in compliance with the "Guidelines for Writing a Thesis or Dissertation" available from the Graduate College Office. The original copy of the thesis must be submitted to the Graduate College for *a format/record check at least two weeks prior to the scheduled defense.* Students must also provide copies of the thesis to members of their Thesis Defense Examination Committee at least two weeks before the scheduled examination. Individual departments may require earlier deadlines.

Students must enroll in GRAD 399: Thesis Defense prior to defending their thesis.

The oral defense of a thesis can be scheduled only after successful completion of the comprehensive examination and the submission of an original copy of the thesis to the Graduate College for a format/record check.

Thesis Defense Examination Committee. The Thesis Defense Committee consists of at least three University of Vermont faculty members, *at least two of whom must be regular members of the Graduate Faculty.* Ordinarily, two committee members will be from the candidate's program, including the thesis advisor. The third member, who acts as ***chair of the committee, must be a member of the Graduate Faculty, must be from a different program and department than the candidate,*** *and must be approved by the Graduate Dean upon nomination by the thesis advisor.*

The Chairperson of the Thesis Defense Committee has the responsibility for ensuring proper conduct of the examination, appropriate documentation of the results, and that the signatures of endorsement are added to the acceptance page of the thesis following a successful defense.

The acceptability of the thesis is determined by the Thesis Defense Committee. A grade of "S" or "U" is awarded. If a student's Defense Examination performance is not satisfactory, then only one re-examination is permitted.

After a successful thesis defense, candidates must forward an original and two copies of the corrected thesis to the Graduate College within the time period specified by the Thesis Defense Examination Committee, and/or the Graduate College.

Options within Master of Arts and Master of Science Programs. At least 21 hours of graduate credit, including credit for the thesis and research leading to the thesis, must be earned in the field of specialization. All course credit included in these 21 hours must be earned in courses which have been approved for graduate credit. Students may wish to include in their programs up to nine hours of graduate level courses outside their fields of specialization. These courses must be approved in advance by the student's advisor or studies committee.

Additional Requirements for the Master of Arts in Teaching. The Master of Arts in Teaching degree is intended only for individuals who are licensed teachers or who are able to be licensed before completing the M.A.T. degree. The degree does not provide licensing. The program requires a minimum of 30 semester hours of course work; at least 21 hours must be taken in the academic field, and at least six hours must be taken in education courses at The University of Vermont. Applicants not qualified for licensing can not expect to receive the M.A.T. degree in one academic year. It is expected that applicants have completed undergraduate majors within the area of specialization.

At The University of Vermont, the Post-Baccalaureate Teacher Preparation Program has been established as the entry level teacher licensure program at the graduate level. Its coordinator is Professor Clinton Erb, 533 Waterman; telephone (802) 656-3356. Please contact him for information and program application forms, the deadline for submission of which is April 1. Applicants to all M.A.T. fields except Occupational and Practical Arts who are not licensed teachers must apply to and be accepted into this program, unless they choose to obtain licensure elsewhere. Thus, for most M.A.T. applicants who are unlicensed, it will be necessary to submit applications to: (1) the Graduate College for admission to the M.A.T., and (2) the Post-Baccalaureate Teacher Preparation Program administered by the College of Education and Social Services. Again, it is important to emphasize that UVM awards the M.A.T. degree only to those individuals who are licensed teachers.

In addition to the comprehensive examination in the field of specialization, students must also take a comprehensive examination in the field of education. Consult specific program listings for additional requirements for this degree program.

Additional Requirement for the Master of Science for Teachers. Applicants for the Master of Science for Teachers must be licensed teachers. Students in a Master of Science for Teachers program may apply more than one three-hour, 100-level course toward their degree. Consult specific department listings for additional requirements and policies related to this degree program.

General Requirements for the Degree of Doctor of Education

Please consult the program description for specific degree requirements.

General Requirements for the Degree of Doctor of Philosophy

In addition to the requirements described below, individual programs may have their own specific requirements. Students should consult and familiarize themselves with their program requirements. Some of them are detailed in this catalogue under individual program listings and other requirements are available from the director or chairperson of each program.

Credit Hours. The degree of Doctor of Philosophy requires a minimum of 75 credit hours earned in courses and in dissertation research. A minimum of 15 hours in courses used in compilation of the grade-point average must be taken in residence at The University of Vermont. Consult individual programs for additional information. Generally, the first year of each doctoral program consists almost entirely of required courses. With the prior approval of their department and the Graduate College, students may apply two 100-level, three-credit courses towards their graduate programs. A student's advisor must petition the Graduate College for approval *before* the student enrolls in the course. Consult individual programs for further limitations. Under no circumstances will a course numbered below 100 be applicable to a doctoral program.

Minimum Residence Requirements. Candidates for the doctoral degree must satisfactorily complete a minimum of 51 hours in residence. The residency requirement is completed by courses that (1) are taken for graduate credit through The University of Vermont either in the academic year or summer on the main campus or at off-campus locations, and (2) are taken after the student has been admitted to the Graduate College. Some programs may require more than the above minimum hours in residence. Consult with the individual program.

Teaching Requirement. All doctor's candidates must acquire appropriate teaching experience in their chosen fields prior to the award of the degree. The nature and amount of teaching, for which no academic credit is allowed, will be determined by each candidate's program.

Language Requirement. Consult the program to determine whether it requires a demonstration of competency in one or more foreign languages. The requirement is fulfilled by an examination administered by the program or in conjunction with the appropriate language department. Enroll for the examination as GRAD 485. There is no fee for taking the exam. The examination is awarded the grade of "S" (Satisfactory) or "U" (Unsatisfactory). The examination may be taken more than once.

If department policy substitutes competence in computer literacy, the language requirement may be fulfilled either by completing appropriate Computer Science courses with a grade of B (3.00) or better, or by satisfactorily completing an examination composed and graded by the staff of the University Computing Center. Individual programs may set additional requirements.

Studies Committee. It is the responsibility of the Studies Committee to supervise the graduate student's program and to review progress at regular intervals. A Studies Committee consisting of at least three regular members of the Graduate Faculty is appointed by the department chairperson or designated departmental representative and approved by the Dean of the Graduate College as soon as possible following enrollment as a duly admitted student of the Graduate College, unless the student's department employs an alternative approved procedure. The Chairperson of the Studies Committee serves as the student's academic advisor and also as the dissertation advisor or supervisor. *In all usual cases, only a regular member of the Graduate Faculty can serve as an advisor of a doctoral dissertation.* On occasion, it may be appropriate for a professional other than a regular member of the Graduate Faculty to serve as a member of a Studies Committee. In such cases, *written approval* of such a member must be obtained from the Dean of the Graduate College *prior* to the student's beginning dissertation research.

Comprehensive Examination. A written comprehensive examination in the field of study must be passed by the candidate *at least six months before the dissertation is submitted.* The examination must be prepared by the department concerned, in consultation with the candidate's Studies Committee. Only one re-examination is permitted. *Success in the written comprehensive examination is prerequisite to standing for the oral Dissertation Defense Examination.* All examinations are taken on The University of Vermont campus in Burlington. Some programs also require an oral comprehensive examination.

Students must enroll in GRAD 497: Doctoral Comprehensive Examination prior to taking the comprehensive examination. There is no fee. A grade of "S" or "U" is recorded.

Research and Dissertation. Each candidate, while in residence at The University of Vermont, must complete an acceptable original research project which contributes new knowledge or techniques in an academic field. Each candidate must enroll in a minimum of 20 credits of dissertation research. *Only a member of the Graduate Faculty may supervise dissertation research for the Ph.D.*

A dissertation must be prepared and submitted in compliance with the "Guidelines for Writing a Thesis or Dissertation" available from the Graduate College Office. The original copy of the dissertation must be submitted to the Graduate College *for a format/record check at least two weeks prior to the scheduled oral defense.* Each student must also provide copies of the dissertation to members of the Dissertation Defense Examination Committee at least two weeks before the scheduled examination. Individual departments may require earlier deadlines.

Students must enroll in GRAD 499: Dissertation Defense prior to defending their thesis.

The oral defense of a dissertation can be scheduled only after successful completion of the comprehensive examination and the submission of an original copy of the dissertation to the Graduate College for a format/record check.

Dissertation Defense Examination Committee. Upon receipt of a completed dissertation, the Dean of the Graduate College will appoint a Dissertation Defense Committee based upon nominations submitted by the candidate's advisor. The Dissertation Defense Committee consists of a minimum of four University of Vermont faculty members, *usually all regular members of the Graduate Faculty. At least two Graduate Faculty members must be from inside the department.* ***At least one Graduate Faculty member must be from outside the candidate's department and program.*** *This member will be designated Chairperson by the Graduate Dean upon nomination by the dissertation advisor.* In-

dividual programs may require more than four committee members or have other specific membership requirements.

The Chairperson of the Dissertation Defense Committee has the responsibility for ensuring proper conduct of the examination, appropriate documentation of the results, and that the signatures of endorsement are added to the acceptance page of the dissertation following a successful defense.

The acceptability of the dissertation is determined by the Dissertation Defense Committee. A grade of "S" or "U" is awarded. If a student's Defense Examination performance is not satisfactory, then only one re-examination is permitted.

After a successful dissertation defense, candidates must forward an original and three copies of the corrected dissertation to the Graduate College within the time period specified by the Dissertation Defense Examination Committee and/or the Graduate College.

STUDENT RIGHTS AND RESPONSIBILITIES

Students have the responsibility to familiarize themselves with the policies and procedures of the University, the Graduate College, and their department or program. *Students are primarily responsible for knowing the degree requirements and following the policies which govern their academic program.* If students have concerns or doubts about individual policies and procedures and are not sure where to turn for help, they may contact their advisor, their program or department chairperson, or the Graduate College Office.

University policies and those of the Graduate College are contained in *The Cat's Tale* and this catalogue, respectively. Copies of *The Cat's Tale* are distributed to new graduate students. Additional copies are available from the Graduate College and the Office of the Dean of Students. In cases of conflict, the *Graduate Catalogue* supersedes academic policies in *The Cat's Tale.*

Advising. Unless a department or program employs an alternative approved procedure, each graduate student will have a faculty advisor to advise on matters of course selection, research direction, and overall guidance from admission to the Graduate College to completion of degree requirements. The initial advisor is assigned by the Department Chairperson or the Department Coordinator for graduate students prior to or shortly after enrolling in the Graduate College. If an initial advisor is not assigned by either of the above parties within two weeks after the initiation of course work in a given graduate program, the student is encouraged to contact an Associate Dean of the Graduate College in order to address this matter. Many times, one faculty member serves as an initial advisor for several students, and it is not uncommon that the advisor may change as the student's program and research interests become refined and definite.

Another common model, especially in doctoral programs, is a Studies Committee comprised of appropriate faculty who share a student's scholarly and professional interests. The committee meets regularly to discuss the student's progress and consult with the student regarding academic development.

While there are a variety of advising models, students have the right to consult regularly with their academic advisor or studies committee. Each year, a copy of each student's academic record is sent to the appropriate program or department. Students should review this record with their advisor and report immediately to the Graduate College Office any errors that appear on it. This record is not an official transcript and should be used for advising purposes only.

Professional Ethics and Academic Honesty. Graduate students are expected to adhere to the highest standards of professionalism as students, researchers, and teachers. The intellectual climate and academic integrity of the University cannot be compromised, and serious offenses insult the integrity of the entire academic community of the University.

The University, in order to encourage a positive atmosphere in all phases of academic learning, teaching and research created specific guidelines and policies regarding academic honesty. They are discussed in detail in *The Cat's Tale* and are also available from the Office of the Provost.

Sexual Harassment. No member of the University community may sexually harass another. Unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature constitute sexual harassment when:

a. submission to such conduct is made either explicitly or implicitly a term or condition of an individual's employment or education;

b. submission to or rejection of such conduct by an individual is used as the basis for academic or employment decisions affecting that individual; or

c. such conduct has the purpose or effect of substantially interfering with an individual's academic or professional performance or creating an intimidating, hostile, or offensive employment, educational, or living environment.

Any University of Vermont student having a complaint of sexual harassment should notify the Office of Affirmative Action and Equal Opportunity. If a student believes that she/he has been sexually harassed, the student is encouraged to contact the Vice-President for Student Affairs. If a student has personal concerns regarding sexual harassment, confidential counseling can be arranged through the Counseling and Testing Center. Policies and procedures governing complaints of sexual harassment are available in each dean's, department head's and chairperson's office as well as in the Bailey/Howe Library.

Discrimination. The University community cannot tolerate discrimination. The Notice of Nondiscrimination, including a statement regarding policies and procedures, is published in the front of this catalogue.

Appeals. Students who believe that they have (1) suffered a violation of due process, (2) been subject to a decision with no rational basis or an abuse of discretion, or (3) suffered a violation of a fundamental right may file a grievance, following procedures outlined in *The Cat's Tale.*

The Graduate College specifically hears all griev-

ances regarding policies and procedures within the province of the Graduate College or any that affect graduate education. Specifically excluded are grievances that contest grades on grounds other than those enumerated above.

A grievance properly begins within the student's own department by an appeal to a program director or chair. If this does not resolve the grievance, the student can present the grievance in writing to the Dean of the Graduate College. Grievances should very clearly and precisely state the basis for appeal and provide supporting evidence that a student's rights have been jeopardized. The Dean may recommend that the grievance be reviewed by the Graduate College Executive Committee. After a thorough review, the Committee reports its findings to the Dean, who is the final arbiter of Graduate College regulations. Students retain the right to appeal the Dean's decision to the Provost.

If the grievance does not fall within the province of the Graduate College, consult *The Cat's Tale* regarding university grievance policy and procedures.

Transcripts. An official transcript is the reproduction of a complete, unabridged permanent academic record validated with the University seal, facsimile signature of the Registrar, and date of issue. A Key to Transcript is included. Currently enrolled as well as former graduate students may obtain an official transcript of their permanent academic record by writing the Office of the Registrar, 360 Waterman Building. Please allow a minimum of one week for normal processing and three weeks following the end of a semester. Transcripts are not released when there is an indebtedness to the University. A fee of $5 is charged for the first transcript, and $2 per transcript is charged for additional transcripts requested at the same time as the first. No fee is charged for a transcript sent within the University.

Access to Records. Students have the right to review any of their educational records maintained by the University. Students also have the right to have all educational records maintained in a confidential manner. In appropriate situations, students may choose to waive some or all of these protections, but such waivers must be clearly stated in writing. If a student feels an educational record to be misleading, or containing information which is inaccurate, a hearing may be scheduled to seek appropriate modification. Requests for reviews of records should be made to the Registrar.

Name and Address Exclusion. The Family Educational Rights and Privacy Act of 1974 grants to all University students the right not to have personal information contained in the records of the University released to any individual, agency, or organization. UVM feels that the following categories constitute such personal information:

Category I	Name, address, telephone number, dates of attendance;
Category II	Class, previous institution(s) attended, major field of study, awards, honors (including dean's list), degree(s) conferred (including dates);
Category III	Past and present participation in officially recognized sports and activities, physical factors (height, weight);
Category IV	Date and place of birth.

Students who do not wish to have one or all of the above categories of information released should fill out an information exclusion card at the Registrar's Office.

CONFERRAL OF GRADUATE DEGREES

Degrees are conferred only in October, March, and May of each year. Diplomas are given only in May.

Educational and Living Expenses

The tuition and fee charges listed here are for 1992-93 only and are subject to change in future years.

Tuition. Rates for the 1992-93 academic year are as follows: For Vermont residents, $240 per credit hour, $2,870 flat rate for 12 hours, and $240 per credit hour in excess of 12 hours.

For nonresidents of Vermont, $598 per credit hour, $7,170 flat rate for 12 hours, and $598 per credit hour in excess of 12 hours.

The lower rates for Vermont residents are made possible by a subvention to the University from the State of Vermont.

GRADUATE STUDENT FEES

Application Fee. All applications for admission must be accompanied by a $25 application fee. This fee is nonrefundable.

Continuous Registration Fee: GRAD 900. A fee of $100 per semester is charged each graduate student who has enrolled for all credits required in the degree program but who has not completed all degree requirements (e.g. comprehensive examination, thesis defense) in order to maintain continuous enrollment. Students who have not cleared grades of I or XC, but who have enrolled for all required course work must pay this fee.

Comprehensive Fee. Students enrolled in fewer than 12 credit hours pay a Comprehensive Fee each semester in lieu of the library and athletic fees according to the following schedule: 0-3 (including Continuous Registration), no fee; 4 credits, $48; 5 credits, $54; 6 credits, $60; 7 credits, $67; 8 credits, $73; 9–11.5 credits, $79.

Transportation Fee. A $44 per year ($22 per semester) fee is charged to all students enrolled for 12 or more hours. This fee is assessed to fund the capital and operating costs for the all-campus shuttle.

Student Health Fee. A fee of $86 per semester is charged all degree students enrolled at the University for 12 credit hours or more. Students enrolled for fewer than 12 credit hours are eligible for University Health Services by paying this fee.

Student Accident and Sickness Insurance. Through an arrangement with a commercial insurance company, students are able to procure health insurance which is designed to provide coverage for services beyond those provided by the Student Health Center. There is an additional charge for this extended coverage beyond the student health fee. The estimated 1992-93 cost for one year's coverage for single students is $364. Married students may obtain coverage for their spouse and children. Further details are available from the Student Health Center. To participate in this insurance, the student health fee must be paid each semester as well as the additional insurance premium.

Reactivation Fee. Reactivation following withdrawal without an approved leave of absence requires payment of a $25 reactivation fee.

Advanced Degree Fee. The fee charged to each advanced degree recipient is as follows:

Doctoral Degree	$25
Master's Degree (with thesis)	20
Master's Degree (without thesis)	10

This fee may be paid at any time but must be paid prior to the deadline established for submission of doctoral dissertations or master's theses for each of the three graduation periods.

It is the responsibility of the degree candidate to pay the appropriate advanced degree fee at the Graduate College Office, 335 Waterman, in order to have a degree awarded.

Penalty Payments. Students who are allowed a payment postponement of all or a portion of their financial obligation will be charged a $50 late payment service charge. There is also a late enrollment fee of $10.

Housing and Living Expenses. The University offers a variety of housing opportunities. Jeanne Mance Hall at the northwest edge of campus offers dormitory accommodations for graduate students. Each room is furnished with a bed, dresser, wardrobe and refrigerator. A kitchen and laundry center is located on each floor. Computer and study areas are located on the first floor. The maximum rates for the 1992–93 fall and spring semesters are $372 per month for a single room. Summer rates are lower. In addition, a limited number of University-owned apartments are available for married and graduate students. The apartments are located at Fort Ethan Allen in Colchester on a bus route five miles from the main campus. For detailed information about either housing option, contact the Ethan Allen Housing Office, 1007 Ethan Allen Avenue, Colchester, VT 05446 (802/655-0661). If considering university housing, contact the Housing Office as soon as possible.

Graduate students may participate in a partial or full meal plan from Marriott Food Services and take

their meals at a number of locations around campus. For 1992–93, the full meal plan is $879; the lite plan is $739.

Up-to-date listings for available apartments, houses, and rooms for rent in the area are maintained by the Department of Residential Life. This service allows community landlords and rental agents to make known housing opportunities to persons associated with the University. Students may also examine listings at the Billings Center or on a bulletin board just off the College Street entrance to Waterman Building on the main campus. The University is not responsible for the approval of off-campus housing facilities. A catalogue of available listings is issued each May, August, and December and may be viewed at the Office of Residential Life, Robinson Hall, Redstone Campus, University of Vermont, Burlington, VT 05405 (802) 656-3434. Rents in the Burlington area vary from approximately $75 per week for a single furnished room to $600 or more per month for a two-bedroom apartment. A single student should expect minimum overall living expenses of approximately $600 per month. If desired, meals may be obtained in University dining halls.

Bill Adjustment. A refund of 100 percent will be processed for enrollment reduction effected prior to the start of the semester; an 80 percent refund will be in effect for reductions in enrollment taking place from the first day of classes through the end of the second week of classes, a refund of 40 percent will be allowed for reductions during the third, fourth, and fifth week of classes; no refund will be processed thereafter. At the end of the semester, an audit will be made of each student's record. If the audit reveals that total credit hour enrollment is greater than at the end of the specified drop period, the student will be financially liable for the total enrollment. Students will be charged for all hours as specified in policy statements regarding tuition.

Withdrawals. A student may voluntarily withdraw from the University by notifying the Graduate Dean and the Registrar. The student will receive a refund in accordance with the bill adjustment policy. Date and time of withdrawal normally will be the date the withdrawal notice is received by the Registrar.

Dismissal. If a student is suspended or dismissed, a refund will be processed according to the bill adjustment schedule.

Death. In case of death of the student, tuition which has been paid for the semester during which the death occurs will be fully refunded.

UNIVERSITY RESIDENCY REGULATIONS IN-STATE STATUS REGULATIONS

The Vermont Legislature has established a lower rate of tuition for students who are Vermont residents. These regulations define eligibility requirements for in-state status classification. All students at The University of Vermont and State Agricultural College (UVM) shall be assigned in-state or out-of-state status classification consistent with these regulations. A Vermont domicile must be established for a student to be eligible for in-state status.

In-State Status Classification Rules

1. Domicile shall mean a person's true, fixed, and permanent home. It is the place at which one intends to remain indefinitely and to which one intends to return when absent.
2. As one element of domicile, a student must reside in Vermont continuously for one year prior to the semester for which in-state status is sought.
3. A residence established for the purpose of attending UVM shall not by itself constitute domicile.
4. An applicant becoming a student within one year of first moving to the state shall have created a rebuttable presumption that residency in Vermont is for the purpose of attending UVM and/or acquiring in-state status for tuition purposes.
5. A domicile or residency classification assigned by a public or private authority neither qualifies nor disqualifies a student for UVM in-state status. Such classification may be taken into consideration, however, in determining the student's status at UVM.
6. It shall be presumed that a student who has not reached the age of majority (18) holds the domicile of his/her parents or legal guardian(s).
7. Receipt of financial support by a student from his/her family shall create a rebuttable presumption that the student domicile is with his/her family, regardless of whether the student has reached the age of 18.
8. A student who has not reached the age of 18 whose parents are legally separated or divorced shall be rebuttably presumed to hold the domicile of the parent with legal custody.
9. A student of parents legally separated or divorced may be granted in-state status if a noncustodial or joint custodial parent is domiciled in Vermont and has contributed more than 50 percent of financial support for at least one year prior to the semester for which in-state status is sought.
10. The burden of proof as to eligibility for in-state status rests with the student. Eligibility must be established by clear and convincing evidence.

In-State Status Classification Documentation

11. The student must submit with the application form all relevant information.
12. The classification decision shall be based upon information furnished by the student, information requested of the student, and other relevant information available consistent with University policies and procedures and legal guidelines.
13. Testimony, written documents, affidavits, verifications, and/or other evidence may be requested.
14. The student's failure to produce information requested may adversely affect the decision for in-state status.
15. A student or others furnishing information may request the deletion from documents of irrelevant private data.

In-State Status Classification Appeals

16. The decision of the Residency Officer must be appealed in writing to the Residency Appellate Officer within thirty (30) calendar days of the date of the Residency Officer's written decision. Appeal to the Residency Appellate Officer is the final appeal at UVM.

In-State Status Reclassification

17. A student who does not qualify for in-state status classification may reapply for such classification each subsequent semester.
18. In-state status classification becomes effective the first semester following the date of successful application.

Re-Examination of Classification Status

19. Classification status may be re-examined upon the initiative of the Residency Officer in the exercise of sound discretion. Circumstances such as periodic enrollment may be cause for re-examination.

Adopted by the Board of Trustees, December 14, 1974; amended June 13, 1981, and May 2, 1987. These regulations took effect with the 1987-88 academic year.

Fellowships, Assistantships, Traineeships, Stipends, and Grants

Students who wish to be considered for fellowships as well as admission must submit completed applications, with supporting materials, by March 1 *of the academic year preceding that for which application is made (February 1 for Psychology). Any applicant requesting fellowship, assistantship, or traineeship support must submit an official copy of the Graduate Record Examination score report.*

Application for fellowships must be made by completing the appropriate section on the application form. No separate form is required except where indicated below.

Tuition scholarships accompanying Graduate Teaching, College, Research, and Student Personnel Fellowships do not cover physical education courses and activities nor do they cover courses numbered below 200 except upon prior approval of the Dean of the Graduate College.

GRADUATE COLLEGE FELLOWSHIPS

The Graduate College offers ten fellowships in support of master's degree programs in the social sciences and humanities. Five fellowships provide a stipend (currently $4,000) and a full tuition scholarship (36-credit hour maximum) for the degree program. The remaining five fellowships provide full-time scholarship only.

The fellowships are open to prospective students in the social sciences and humanities at the time of application. Holders of Graduate College Fellowships are required to carry full-time enrollment towards an advanced degree. The fellowships are not renewable.

GRADUATE TEACHING FELLOWSHIPS AND GRADUATE RESEARCH FELLOWSHIPS

Graduate Teaching Fellowships are awarded by many of the departments offering graduate work. Graduate Teaching Fellows are generally appointed for nine months with stipends averaging $9,200 for 1992-93. Normally, Teaching Fellows may enroll for a maximum of ten hours per semester. In addition to the stipend, the fellowship award includes a tuition scholarship covering the number of credit hours specified in the award letter but not to exceed ten credit hours per semester during the period of the fellowship.

Graduate Research Fellowships are awarded in some of the science departments offering graduate work. Research Fellows may be appointed for nine or 12 months with stipends generally ranging from $9,200 to $12,500 and a tuition scholarship (see limits in Teaching Fellowship description). A maximum of half-time assistance in the department is expected of Graduate Teaching and Research Fellows, and they must expect that more than one academic year will be necessary to complete the requirements for the master's degree. If a Teaching or Research Fellow is a candidate for the doctoral degree, at least four calendar years must be anticipated for completion of the academic program. Generally, fellows are appointed in the departments in which they are doing graduate work.

Appointments will be announced on or about the first week in April.

HIGHER EDUCATION AND STUDENT AFFAIRS FELLOWSHIPS (HESA)

Graduate students are also eligible to apply for HESA Fellowships. The candidates selected to fill these positions will normally be assigned administrative and advisory positions in the residence halls, although limited opportunities in other student services areas are available as well. HESA Fellows have the opportunity to gain valuable experience in the areas of group advising, administration, personnel advising and educational programming. Such positions are open to either married or single students who have been accepted for graduate work in any of the academic programs of the University. Selection is based upon academic record, character, recommendations, and quality of related experiences. A personal interview is required. Requests for applications and additional information should be addressed to Office of Residential Life, Robinson Hall. Applications received after March 1 will be considered only for unanticipated openings. Appointments will be announced on or about May 1.

GRADUATE ASSISTANTSHIPS

Graduate Assistantships are generally available when a department member receives a grant from a source external to the University. The appointment may be for either nine or 12 months at a starting salary of about $14,000 and $16,000 per appointment period (1992–93). Part of the salary is for tuition at the in-state rate with a maximum enrollment of ten credit hours each semester and nine credit hours during the summer session (12-month appointments).

A maximum of one-half time assistance on the research project is expected and more than one academic year will be necessary for the completion of the master's degree and at least four calendar years for completion of the doctoral degree. For information on the availability of assistantships, contact the chairperson of the department.

GRADUATE TRAINEESHIPS

Graduate traineeships are available in certain departments through grants from various state and federal agencies. Traineeships are available currently to graduate students enrolled in the following departments or programs: Biochemistry, Cell and Molecular Biology, Pathology, and Psychology. These traineeships generally include both a stipend and tuition scholarship.

UVM OPPORTUNITY FELLOWSHIPS

The Graduate Dean's Office administers several fellowships to assist American multicultural graduate students pursuing advanced degrees in any subject area at UVM. These fellowships are generally funded at a level equivalent to Teaching Fellow stipends. Please indicate interest in these fellowships on the application form.

SUMMER RESEARCH STIPENDS

To promote graduate scholarship and to assist students in completing their programs in a timely and successful manner, the Graduate College provides a limited number of summer research stipends to graduate students. The stipends, awarded competitively, are designed to help students devote the summer to some phase of their dissertation, thesis, or final research project. Details about the stipends are available from the Graduate College Office.

TRAVEL GRANTS

The Graduate College upon recommendation from the Graduate Student Advisory Committee provides mini-travel grants to help students underwrite the cost of attending conferences where they will present papers or posters of their research. These funds are awarded three times a year on a matching basis with the student's home program or department. Applications for grants are available from the Graduate College Office.

OTHER FELLOWSHIPS

A limited number of fellowships established by private donors are available periodically in selected departments.

Financial Aid

Limited amounts of need based financial aid are available for students enrolled in the UVM Graduate College. Much of the available aid consists of low interest student loans, repayable after graduation or upon withdrawal from the University. Those students with financial need who do not receive supplemental assistance in the form of assistantships or fellowships may find that their need based financial assistance is insufficient to meet their entire cost of attendance. It is important, therefore, for graduate students to fully assess their costs and resources before making a final decision about attendance.

The University provides, through the Office of Financial Aid, long-term loans and/or work-study jobs for students based upon demonstrated need remaining after all assistantships, fellowships, traineeships, tuition grants, and any other source of financial assistance are considered.

In order to be considered for financial assistance, an applicant must meet the following requirements:

1. U.S. citizenship (or permanent resident status)
2. At least half time enrollment
3. Financial need as determined by federal eligibility requirements

Application for financial aid should be made as soon after application for admission to the University as possible. In order to apply for aid, graduate students are required to complete the Financial Aid Form of the College Scholarship Service. The priority deadline for filing a Financial Aid Form with the College Scholarship Service is March 1 of each year. Applicants will also be asked to provide copies of prior year income tax returns and Financial Aid Transcripts from institutions previously attended. After admission to the University and upon submission of all required documentation, applicants will be notified of financial aid eligibility.

LOAN PROGRAMS

• STAFFORD LOAN PROGRAM. The Stafford Student Loan Program (formerly Guaranteed Student Loans) is available for needy graduate students. Loans may be obtained through state lending agencies and private lenders. Graduate students are eligible to borrow a maximum $7,500 per year, depending upon need, up to a total of $54,750. This latter total includes any Stafford Loans received as an undergraduate. Stafford Loans are interest-free while the student is enrolled at least half-time in a degree program. The interest rate thereafter is eight percent and repayment begins six months after leaving school or reducing enrollment to less than half-time.

• SUPPLEMENTAL LOAN FOR STUDENTS PROGRAM. The Supplemental Loans for Students (SLS) Program provides loan funding up to a maximum of $4,000 per year, with a cumulative total of $20,000. Payments on the loan principal may be deferred until after graduation. Repayment of interest (the rate is variable) begins 60 days following receipt of the loan check.

• PERKINS LOAN PROGRAM. A very limited number of Perkins Student Loans are available for graduate students and are administered by The University of Vermont. The amount of the loan will depend upon available funds. Perkins Loans are interest-free while the student is enrolled at least half-time in a degree program. The interest rate thereafter is five percent and repayment begins six months after leaving school or reducing enrollment to less than half-time.

JOB PROGRAMS

• COLLEGE WORK STUDY PROGRAM. A limited amount of College Work Study funding is available for needy graduate students. The College Work-Study Program (CWSP) provides financial assistance through employment on campus or with certain kinds of off-campus agencies. Students have the opportunity to select jobs in their field of study, interest, and skills.

• The Center for Career Development assists students in locating other part-time job opportunities. Students should contact the Career Development Office, E Building, Living/Learning Complex.

APPLICATION FOR FINANCIAL AID

Application forms are available from the Office of Financial Aid, 330 Waterman Building. Only one application is needed in order to apply for aid. The aid application deadline is March 1. Applications received after that due date will be reviewed according to the date of submission. If additional information is required, the Office of Financial Aid will contact the student. Please note that any tuition grants, fellowships or assistantships are considered a financial aid resource, and must be considered before other University student aid will be awarded.

FINANCIAL AID REFUND POLICY

For students receiving financial aid, change in student status or credit hour load may result in revision or loss of financial aid, depending on the regulations governing the particular aid programs involved.

SATISFACTORY ACADEMIC PROGRESS FOR FINANCIAL AID RECIPIENTS

In order to maintain eligibility for financial aid, matriculated undergraduate and graduate students must progress at a rate that ensures completion of their degree programs within a reasonable time frame. Beginning with the first semester of study in a degree program at The University of Vermont, a federal financial aid recipient is required to accumulate earned hours totaling at least 75 percent of the number of hours attempted. Each student's progress will be measured at the end of each year of attendance to ensure adherence to this standard.

All students must have attained at least a 2.0 overall cumulative grade point average in order to continue to qualify for assistance.

Any student not meeting the standard described above will be placed on Financial Aid Probationary Status for a one year period (during which aid eligibility will be maintained). Should the student not meet the required credit standard or cumulative grade point average standard by the end of that probationary year, the student's eligibility for additional financial aid will be withdrawn until the student has met the required standard.

Students whose aid is withdrawn for not maintaining academic progress according to the standard outlined above may appeal their loss of aid by writing to the Director of Financial Aid. The decision to withhold aid eligibility may be overridden by the Director and a five member appeals committee in circumstances which warrant special consideration. Such circumstances may include but are not limited to medical emergencies or family crises which resulted in the student's not meeting the stated requirements.

FOR ADDITIONAL INFORMATION

More detailed information about the financial aid opportunities and procedures may be obtained from the UVM Office of Financial Aid located in Waterman Building Room 330. Their staff may be reached at (802) 656-3156.

The awarding of financial aid is administered in accordance with the University's guidelines on nondiscrimination described in this catalogue.

VETERANS BENEFITS

Students who are eligible to receive educational benefits from the Veterans Administration should obtain advice from the Center for Career Development, E Building, Living/Learning Center, (802) 656-3450.

NEW ENGLAND REGIONAL STUDENT PROGRAM

An opportunity for qualified legal residents of New England states to enroll at reduced rates for programs which are not offered by the home state university but are offered in another New England state is available under an arrangement entitled the New England Regional Student Program. A list of available graduate programs is available in the "Apple Book" and may be examined in the Graduate College Admissions Office or obtained from the New England Board of Higher Education, 45 Temple Place, Boston, MA 02111.

Applicants must indicate clearly, both in their initial inquiries and on their application forms, that they are seeking admission under the terms of the New England Regional Student Program. In cases where the program of study is clearly unique or distinctive to the out-of-state institution, the UVM Graduate College Dean's Office will certify directly the applicant's eligibility to apply under the New England Regional Student Program. In cases where an apparently similar program of study is available at both institutions involved, the graduate deans of the two institutions will determine whether regional student status is appropriate.

INTERNATIONAL STUDENT SUPPORT PROGRAMS

International students may be eligible for programs administered by the Institute of International Education. Contact the U.S. Embassy, Consulate, or Information Service in their country. Students from Africa, the Middle East, Korea, and other areas may also request information about financial aid from the following:

For Africa: The African-American Institute, 833 U.N. Plaza, New York, NY 10017. For the Middle East: American Friends of the Middle East, Inc., Middle East House, 1607 New Hampshire Ave. N.W., Washington, DC 20009. For Europe, South America, and Southeast Asia: Institute for International Education, 809 U.N. Plaza, New York, NY 10017. For Central and South America: LASPAU, 25 Mount Auburn Street, Cambridge, MA 02138.

Support Services for Graduate Students

Graduate Student Advisory Committee. The Graduate Student Advisory Committee (GSAC), comprised of graduate student representatives from each of the colleges and schools, provides a forum for discussion of graduate student issues and assists the Dean and the Executive Committee in matters affecting graduate students. Issues considered by GSAC range from the academic through professional development and student life. GSAC sponsors occasional social events and conducts a minigrants program to support, in part, expenses associated with student travel for professional purposes.

Office of Multicultural Affairs. The primary goal of this office, is to meet the academic, cultural, social, and emotional needs of the students. The second goal involves providing information and facilitating programs to promote awareness about cultural issues within the University setting. In order for a community to function collectively, a high level of sensitivity must be present among its inhabitants. The Office of Multicultural Affairs helps to educate the community regarding cultural differences, needs, and obstacles facing multiracial students.

A variety of programs each year enhances cultural awareness on campus. These activities which are planned by faculty, staff and students represent the history, achievements, and culture of the multiracial students. Special programs have included guest speakers Shirley Chisolm, Henry Cisneros, Angela Davis, Tony Brown, Roy Innis, Spike Lee, Giancarlo Esposito, Nien Cheng, and Devin Nair, among others. Other major events took place during Hispanic Week, Black History Month and Asian-American Celebration.

The Office of Multicultural Affairs is housed at The Center for Cultural Pluralism. The Center serves as a gathering place for the University community to meet and share its cultural heritages through a variety of social, cultural, and educational events. It also provides a place where students can come to relax and study. Computers, study rooms, cable television, VCR, a stereo, and kitchen facilities are all available at the Center.

Center for Career Development. The Center for Career Development provides assistance in establishing placement credential files, interviewing techniques, and resume writing. Center personnel also provide individual assistance in developing job searches. An extensive career library contains information on full-time positions, along with occupational briefs, job market trends, salary surveys, and company literature. In addition, the office lists limited part-time and summer job opportunities.

Counseling and Testing Center. The Counseling and Testing Center is a campus resource available to students, faculty, and staff. The Center offers confidential individual and group counseling, testing services (including the Graduate Record Examination), and workshops on topics including stress management, study skills, assertiveness, and life planning.

Graduate College Workshops. Each year the Graduate College sponsors writing and teaching workshops for graduate students. A teaching workshop held in early September focuses on ways of enhancing undergraduate education by helping teaching fellows better understand the process of educating college students. A winter writing workshop deals with ways of incorporating and strengthening writing across the curriculum and helps graduate students who might be experiencing some difficulty with their own writing. In the spring, a grant-writing workshop provides training for graduate students who wish to learn how to write grant proposals for external funding. A thesis/dissertation format workshop is held three times a year.

Exercise and Wellness. The University's extensive physical education facilities are available for recreational use by faculty, staff, and students during hours not devoted to specific instruction. Swimming, handball, skating, tennis, squash, and many other individual and group activities are available for interested participants.

In addition to the physical education facilities, the University has an active Outing Club. There are many opportunities in Vermont for participation on either an organized or informal level in such activities as hiking, camping, sailing, swimming, skiing, running, bicycling, and other outdoor activities.

Courses of Instruction

Course Numbering

Courses numbered 400 or above are limited to candidates for the degrees of Doctor of Education and Doctor of Philosophy; courses numbered 300 to 399 are generally limited to graduate students; courses in this catalogue, numbered 200 through 299, are advanced courses for undergraduates which may also be taken for graduate credit by graduate students. *To obtain graduate credit, the graduate student generally is expected to meet higher qualitative and/or quantitative expectations than the undergraduate student.* Courses numbered 100 to 199 may not be taken for graduate credit except upon recommendation of a student's Studies Committee *and with the authorization of the Dean of the Graduate College prior to enrollment.* Authorization will be limited to one appropriate course (three credit hours) for a master's program and to two appropriate courses (six credit hours) for a doctoral program. Graduate students may take additional 100-level courses beyond these values, but graduate credit will not be allowed for such courses. Graduate programs designed for the Master of Science for Teachers degree (M.S.T.) are exempted from this rule. Nondegree students are not permitted to receive graduate credit for courses numbered 100-199. Under no circumstances will graduate credit be allowed for a course numbered below 100.

The form 201, 202 indicates that two such courses may be taken independently for credit.

The form 201-202 indicates that such courses may *not* be taken independently for credit and, unless otherwise stated, must be taken in the sequence indicated.

The number of credit hours *per semester* is indicated in each course description that follows.

All prerequisites cited refer to courses as numbered at The University of Vermont.

A student who lacks the stated prerequisites for a course, but is otherwise qualified to take it, may be permitted to enroll by the instructor.

While every attempt has been made to list only courses that actually will be offered, the College necessarily must reserve the right to withdraw scheduled offerings or substitute for them should circumstances make such changes necessary.

Graduate Degree Programs and Courses of Instruction

Agricultural Biochemistry (AGBI)

Professor Weller; Associate Professor Currier (Chairman); Research Associate Professor Kent; Lecturer Lauzon.

Research programs include the microbial/biochemical ecology of tephritid flies (C. Lauzon); identification of proteins in plant parts (D. Weller); mechanism of biorecognition between host plant and rhizobia (W. Currier); properties of Rubisco enzyme involved in photosynthesis and photorespiration (S. Kent). Members of our faculty participate in the interdisciplinary Cell and Molecular Biology Program (see separate listing in this catalogue).

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

An undergraduate major in biochemistry, chemistry, nutrition, or biology including a year in organic chemistry, with laboratory. Courses in biochemistry, and organic chemistry are strongly recommended. Satisfactory scores on the Graduate Record Examination (general).

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

Satisfactory completion of one year of study and completion of admission requirements.

MINIMUM DEGREE REQUIREMENTS

Agricultural Biochemistry 201, 202, 220, 221, 230, 231, 381-384; thesis research (10 to 15 hours).

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Same as admission for Master of Science degree. Physical chemistry, courses in cellular and molecular biology, mathematics, and physics suitable for student's program are recommended.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Completion of a full year of graduate study and residency at The University of Vermont. One year of laboratory courses in molecular or cellular biochemistry; approval of the Student's Studies Committee and the Graduate College Dean.

MINIMUM DEGREE REQUIREMENTS

Biochemistry 301-302; advanced courses in chemistry (six hours); additional course work as determined by Student's Studies Committee; participation in seminar throughout residency; doctoral dissertation research (20 to 35 hours).

COURSES OFFERED

201 General Biochemistry. Broad coverage of biochemistry including principles of analytical biochemistry. *Prerequisite:* Chemistry 42 or 141 or equivalent. Three hours and lab (one hour) as 202.

202 General Biochemistry Laboratory (0-3). Introduction to techniques and equipment used for the isolation and quantitative analysis of amino acids, proteins, sugars, and enzymes in biological materials. *Prerequisite:* Credit for or concurrent enrollment in 201. One hour. Lauzon.

210 Quantitative Biochemistry. This course focuses on physical principles of biochemical methods and theory with strong emphasis on problem solving and data analysis. *Prerequisite:* 201. Three hours. Kent.

220 Molecular Biology. The structure and biological function of nucleic acids, proteins, and enzymes. Emphasis is on optical, electrophoretic, and ultracentrifugal methods. *Prerequisite:* 201. Three hours and lab (one hour) as 221. Weller.

221 Molecular Biology Laboratory (0-3). Laboratory practice in protein characterization by disc and SDS-gel electrophoresis and gel isoelectric focusing. DNA separation and characterization by agarose gel electrophoresis and restriction enzyme digestion. *Prerequisite:* Credit for or concurrent enrollment in 220. One hour. Currier, Weller.

230 Advanced Biochemistry. A study of metabolic cycles emphasizing research methods involving radioisotopes and chromatography. *Prerequisite:* 201 or permission of the instructor. Three hours and lab (one hour) as 231. Currier.

231 Advanced Biochemistry Laboratory (0-3). Laboratory experimentation emphasizing absorption, ion exchange, affinity, and partition chromatography. Introduction to modern GLC and HPLC techniques and enzyme isolation, purification, and characterization. *Prerequisite:* Credit for or concurrent enrollment in 230. One hour. Currier.

250 Plant Biochemistry. The study of specific biochemical principles that are unique to plants concentrating on the biochemistry of plant cell walls, photosynthesis, and secondary metabolites. *Prerequisite:* 201. Two hours. Currier.

295 Special Topics. Lectures, readings, laboratory studies, or field trips. Format and subject matter at the instructor's discretion. Spring, summer, and fall. *Prerequisite:* Departmental permission. Credit to be arranged.

301 Special Problems. *Prerequisite:* Departmental permission. Credit as arranged.

381-384 Seminar. A topical seminar with discussion of assigned and collateral reading. Required of graduate students. One hour.

391 Master's Thesis Research. Credit as arranged.

491 Doctor's Thesis Research. Credit as arranged.

Agricultural and Resource Economics (AREC)

Associate Professors Fife, Gilbert, Pelsue (Chairperson), Schmidt; Assistant Professors Condon, Ford, Iskow; Extension Professor Bevins; Extension Associate Professor Bigalow; Extension Assistant Professor Wackernagel; Adjunct Assistant Professor Bancroft; Adjunct Lecturer Silver.

The Department conducts research in agricultural production economics, marketing, and business management. It also has an active research program in the economic and societal impacts of rural development, in both international and domestic areas.

The Department offers options in two areas: Agricultural Economics and Resource Economics. Each student selects an option and then develops, with a studies committee, an academic program.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

For the agricultural economics option: an undergraduate degree in agriculture, economics, business administration, or a related area. For the resource economics option: an undergraduate degree in resource use, economics, recreation, forestry, or the natural sciences.

All students must present satisfactory scores on the general (aptitude) Graduate Record Examination. Transcripts are evaluated on an individual basis.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

Students who are deficient in key subject areas or where transcript grades appear to be marginal may be required to complete satisfactorily certain courses before acceptance as a degree candidate.

MINIMUM DEGREE REQUIREMENTS

Advanced courses in agricultural and resource economics, general economics, or related fields, 21 to 24 hours, thesis research six to nine hours, for a total of 30 hours.

COURSES OFFERED

201 Farm Business Management. Organization and operation of successful farm businesses emphasizing resource allocation, production efficiency, and marginal analysis. Field trips required. *Prerequisites:* 61 or Economics 12; 167 or permission of instructor. Three hours.

205 Rural Communities in Modern Society. See Sociology 205. Three hours.

207 Markets, Food, and Consumers. Learn how producers, processors, wholesalers, cooperatives, retailers, consumers, and governments affect the movement of food and fiber products through the production-marketing chain. *Prerequisite:* 61 or equivalent. Three hours. Pelsue. Alternate years.

208 Agricultural and Food Policy. History and institutional development of agricultural policy. Price and income problems of American agriculture and alternative solutions. *Prerequisite:* 61 or Economics 12 or equivalent. Three hours. Schmidt.

218 Community Organization and Development. See Sociology 207. Three hours.

222 Natural Resources Evaluation. An analysis of economic procedures used in the evaluation of public natural resource developments, emphasizing benefit-cost analysis. *Prerequisite:* 121 or equivalent. Three hours. Gilbert.

225 Economics of Outdoor Recreation and Tourism. A socioeconomic analysis of recreation and tourism as an industry. Emphasis on regional, state, and community impact. *Prerequisite:* 61 or Economics 12 or equivalent. Three hours. Bevins, Gilbert.

233 Rural Planning. Study of rural, regional, water, and natural resource planning concepts and principles. Field exercises in plan evaluation, carrying capacity, agricultural land protection, growth control. *Prerequisite:* 61 or equivalent. Three hours.

237 Economics of Sustainable Agriculture. Comparative economic analysis of small vs. large scale, full vs. part-time farming, traditional vs. alternative agricultural systems, specialization vs. diversification and issues in agricultural sustainability. *Prerequisites:* 61 or Economics 12, or permission. Three hours. Pelsue. Alternate years.

254 Advanced Agricultural Economics. The structure of competitive markets; emphasis on allocation of resources and the theory of price determination. *Prerequisites:* 61 or Economics 12, Math. 19, or permission of instructor. Three hours. Iskow.

255, 256 Special Topics in Agricultural and Resource Economics. Readings and discussion of selected topics in economics, including those not encompassed in regular course offerings, at an advanced level. *Prerequisite:* Departmental permission. Credit as arranged.

264 Price Analysis and Forecasting. Analysis and measurement of factors affecting supply, demand, and elasticity; their relation to the level and changes of market prices; and use of quantitative techniques in forecasting. *Prerequisites:* 61 or Economics 12, Math. 19, or permission of instructor; Computer science and statistics helpful. Three hours. Condon.

266 Small Business Decision Making. Applying economic

concepts to decision making in the small business. Incremental analysis, contribution margins, personnel management, and linear programming will be covered. *Prerequisites:* 166, 167, or equivalent. Three hours. Fife, Iskow.

267 Small Business Planning. Instruction and guidance in the actual process of preparing a business plan. Students prepare their own business plan including a market analysis; and legal, financial, and operational plans. *Prerequisites:* 266, Vocational Education and Technology 85, or equivalent. Four hours. Bevins, Fife.

272 Seminar on World Food Problems and Policies. Review of recent books and periodical literature; discussion and written or oral reports on topics of contemporary interest. *Prerequisite:* Permission of instructor. Three hours. Ford.

273 Agricultural Planning and Project Development. Agricultural sector planning and project development processes with a focus on policy instruments; links between agriculture and the rest of the economy; data requirements; and activity preparation, evaluation, and implementation. *Prerequisite:* 171 or permission of instructor. Three hours. Every other year alternating with 272. Ford.

287 Spatial Analysis. See Geography 287. Three hours. Bodman.

351 Research Methods. Developing research projects with the scientific method; evaluating alternative literature review, sampling, surveying, and analytic methods; and reporting the results. *Prerequisite:* Three hours of statistics. Three hours. Condon.

391 Master's Thesis Research. Credit as arranged.

Anatomy and Neurobiology (ANNB)

Professor Emeritus Young; Professors Parsons (Chairperson), Wells; Associate Professors Cornbrooks, Fiekers, Freedman, Powers; Assistant Professors Braas, Forehand, Mawe, May; Lecturers Ezerman, Fonda, Lee; EM Coordinator Hendricks.

Departmental research activities center around investigations on nervous system structure and function and thyroid cytophysiology. Specific areas of interest include: physiology and pharmacology of synaptic transmission, cytochemistry of neurotransmitter and cyclic nucleotide interactions in the basal ganglia, neuronal regeneration and plasticity using intracephalic implants into adult CNS, development of monoclonal antibodies to analyze Schwann cell-neuronal interactions in tissue culture, analysis of the avian motor system, neuronal "sprouting" and recovery of function, and cellular dynamics of thyroid follicular cells. Additional opportunities exist for a multidisciplinary program in Neurobiology.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

Students are admitted to the Ph.D. program only, not to a M.S. program. Ph.D. students may subsequently complete a M.S. degree with the permission of the Department.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

Satisfactory completion of required courses and Research Rotations. Acceptance of a written report and oral presentation on the proposed thesis as approved by the Research and Dissertation Committee.

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

Thirty credits of courses and research, including Anatomy and Neurobiology 301, 302, 311; comprehensive examination. Additional credits as arranged for laboratory research leading to a dissertation. A grade of B or better must be obtained in any course taken in Anatomy and Neurobiology.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Bachelor's degree; one year of organic chemistry/biochemistry; a year of advanced biology; one course in college physics. Additional courses in calculus, differential equations, statistics, computer science, and physical chemistry are recommended. A deficiency in one prerequisite course can be made up in the summer session before entry into the program. A master's degree is not a prerequisite for the Ph.D. degree. Satisfactory scores on the general (aptitude) Graduate Record Examination.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Satisfactory completion of required courses and research rotations. Approval of the written and oral portions of the qualifying comprehensive examination.

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Anatomy 301, 302, 306, 311, 351 or 352, 395 or 396, and 491; Physiology and Biophysics 301; Biochemistry 301, 302. Additional elective courses and teaching assignments as arranged with the department; three reading courses; departmental research rotations; dissertation research; credits as required by the Graduate College. Candidacy examination; successful completion of dissertation. A grade of B or better must be obtained in any course taken in Anatomy and Neurobiology.

COURSES OFFERED

Note: Departmental permission is required for all courses.

201 Human Gross Anatomy. Lectures and detailed regional dissections emphasize functional anatomy of major systems (e.g. musculoskeletal, cardiovascular, nervous). *Prerequisite:* Permission. Five hours. Mawe, May.

202 Neuroanatomy. Structural basis of nervous system function, including spinal reflex organization, detailed analysis of sensory and motor systems, clinical examples, human brain dissection. *Prerequisites:* 201 or permission. Three hours. Wells.

301 Medical Gross Anatomy. Individualized laboratory instruction, small group conferences, clinically correlated lectures. Basic anatomical information. Emphasis on importance of the relationship between normal human structure and function. Six hours. Ezerman, Fonda, Powers.

302 Neuroscience. A correlated presentation of the neuroanatomy and neurophysiology of the mammalian central nervous system. Lectures, demonstrations, laboratory, and clinical correlation workshops. Four hours. Forehand, Freedman, Parsons.

306 Techniques in Neurobiology. Discussion, demonstration of techniques used to study the nervous system. Experience with light, fluorescence, electron microscopy; microsurgical procedures; electrophysiological stimulating, recording techniques; neuronal tracing techniques. *Prerequisite:* Neuroscience 302. Three hours. Fiekers.

311 Medical Histology. The course as presented to medical students. Microscopic study of cells, tissues, and organs

emphasizing the correlation of structure and function. Three hours. Cornbrooks, Fiekers.

320 Developmental Neurobiology. Embryonic and early postnatal development of selected regions of mammalian CNS. Provides fundamental knowledge of cell-to-cell interactions necessary for proper development, organization of mammalian nervous system. *Prerequisite:* Neuroscience 302 or consent of instructor. Two hours. Cornbrooks. Alternate years.

322 Neuroendocrinology. Consideration of the diencephalic regulation of hormonal activity. The major emphasis devoted to morphological features of hypothalamic mechanisms controlling pituitary hormone secretion. *Prerequisite:* Neuroscience 302. Two hours. Freedman. Alternate years.

325 Advanced Neuroanatomy. Morphology of the nervous system. Lectures and laboratory. Regional approach to anatomy. Units on development, blood supply, autonomic nervous system. Laboratory: brain dissection, microscopic examination (brain stem). *Prerequisite:* Neuroscience 302. Three hours. Freedman. Alternate years.

342 Special Dissections in Gross Anatomy. A detailed and independent study of a single anatomical region, utilizing gross, microscopic, and embryologic materials. *Prerequisite:* 301. Credit as arranged. Fonda, Powers.

351, 352 Techniques in Electron Microscopy. Techniques to produce electron micrographs of biological specimens. Operation of conventional transmission electron microscopes, specimen preparation, interpretation of micrographs. Lecture/demonstration of scanning electron microscopy. *Prerequisite:* Consent of instructor. Credit as arranged. Hendricks.

381, 382 Seminar in Anatomy and Neurobiology. Research presentations and critical review of the literature in various areas of anatomical and neurobiological sciences. One hour.

391 Master's Thesis Research. Credit as arranged.

395, 396 Special Topics in Neuroscience. A supplementary course to the medical neuroscience course (Neuroscience 302) designed for graduate students which will provide more detailed information concerning selected topics in neurobiology. *Prerequisite:* Neuroscience 302. Two hours. Parsons.

491 Doctoral Dissertation Research. Credit as arranged.

Animal Sciences (ASCI)

Professors Bramley (Chairperson), Carew, Foss, Smith, Welch; Associate Professors C. Donnelly, Kindstedt; Assistant Professors Chen, Gilmore, Plaut; Extension Professor Gibson; Research Professor Pankey; Adjunct Professors Ballard, S. Donnelly, Grabber, Hsieh, Thomas.

Research activities in basic and applied science encompass a broad range of interests. The areas of study and research include nutrition; physiology; diseases of cattle affecting quality milk production; dairy foods; chemistry; microbiology; quality control aspects of the food industry.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

An acceptable undergraduate major in the animal sciences, chemistry, biology, or a related field. Satisfactory scores on the general (aptitude) Graduate Record Examination must be presented. In some of the animal health areas, a degree of Doctor of Veterinary Medicine may be helpful.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

The applicant must satisfy the requirements of the Graduate College and pass the general qualifying examination administered by the Department of Animal Sciences.

MINIMUM DEGREE REQUIREMENTS

Fifteen to 21 hours in Animal Sciences and one of several related fields; thesis research (nine to 15 hours).

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Satisfactory scores on the general (aptitude) Graduate Record Examination must be presented.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

The applicant must satisfy the prerequisites of the Graduate College and pass the general qualifying examination administered by the Department of Animal Sciences.

MINIMUM DEGREE REQUIREMENTS

The Department of Animal Sciences believes each graduate program has its individual needs and must be arranged accordingly. The candidate must meet all the requirements as prescribed by the Graduate College for the degree of Doctor of Philosophy. In addition, all courses and seminars as established by the Studies Committee must be satisfactorily met, doctoral research must be completed, and an acceptable dissertation written and defended. In accord with the policy of the Animal Sciences Department, all doctoral students will be provided the opportunity to participate in the Department's undergraduate teaching program. Proficiency in a modern foreign language or computer language and programming is optional at the discretion of the Studies Committee.

201 Fermented Dairy Foods. Fundamental processes in the manufacture of economically important cheese varieties and other cultured dairy foods. Acquired knowledge of manufacturing procedures applied at the pilot plant level. *Prerequisites:* A course in organic chemistry Agricultural Biochemistry 201 or instructor permission. Four hours. Kindstedt. Alternate years, 1992-93.

203 Food Microbiology. Desirable and undesirable activities of bacteria in foods. Mechanics of food-borne infection and intoxication. Laboratory methods to enumerate and identify microorganisms associated with foods. *Prerequisites:* Microbiology 65 or 66, a course in biochemistry or permission of instructor. Four hours. S. Donnelly.

212 Animal Genetics and Breeding. Principles of quantitative and statistical genetics studied in relation to animal breeding. Methods of selection and schemes of mating discussed. *Prerequisites:* Statistics and biology or permission of instructor. Four hours. Gilmore.

213, 214 Dairy Herd Management. Organization and operation of dairy enterprises. Theories and methods of application of feeding, breeding, and management programs and principles. *Prerequisites:* 110 or equivalent. Four hours. Gibson.

215 Physiology of Reproduction and Lactation. Fundamental principles of the physiology of reproduction and lactation with emphasis on, but not limited to, farm animals. *Prerequisite:* 120 or permission of instructor. Four hours. Plaut. Alternate years, 1993–94.

216 Endocrinology. Physiology of endocrine and autocrine/paracrine systems and growth factors. *Prerequisites:*

Course in both biology and physiology; one course in anatomy desirable. Concurrent enrollment in 217 required. Three hours. Plaut. Alternate years, 1994–95.

217 Endocrinology Laboratory. Laboratory techniques used in endocrine research. *Prerequisites:* Corequisite 216 and instructor's permission. One hour.

282 Animal Sciences Graduate Seminar. Reports and discussions of problems and special investigations in selected fields. One to three hours. Pankey.

297, 298 Special Problems in Animal Sciences. Research activity under direction of a faculty member whose approval has been given. Written proposal and report are required. *Prerequisite:* Faculty member permission. May enroll more than once for maximum of six hours. Coordinator.

391 Master's Thesis Research. Credit as arranged.

491 Doctoral Dissertation Research. Credit as arranged.

Anthropology (See page 102.)

Art (See page 102.)

Biochemistry (BIOC)

Professors Chiu, Collen, Cutroneo, Long, Mann (Chairperson), Meyer, J. Thanassi, Woodworth; Associate Professors Auletta, Hart, P. Tracy; Adjunct Associate Professors Crabb, Harris; Assistant Professors Francklyn, Morrical, R. Tracy, Van Houten; Research Associate Professors Church, Mason, N. Thanassi.

Current research programs include studies of mechanisms controlling ovarian function (F. Auletta); regulation of gene expressions in developing and neoplastic tissues (J-F.Chiu); structure and function of blood coagulation proteins (W. Church); physiology and biochemistry of thrombosis (D. Collen); regulation of procollagen synthesis (K. Cutroneo); protein-nucleic acid recognition (C. Francklyn); gene expression in androgen responsive systems (S. Harris); environmental, nutritional, hormonal modulators of pulmonary defense mechanisms (B. Hart); molecular biology, cloning and expression of blood coagulation proteins; site-specific mutagenesis (G. Long); macromolecular assembly in blood coagulation and bone formation (K. Mann); transport of iron into cells by receptor mediated iron-binding proteins (A. Mason); enzymology of protein and nucleic acid processing and breakdown (W. Meyer); enzymology of DNA replication, recombination and repair (S. Morrical); chemistry and biochemistry of vitamin B_6 (J. Thanassi); cellular interactions with coagulation proteins (P. Tracy); determination of thrombosis related cardiovascular disease risk factors (R. Tracy); molecular biology of DNA repair in bacterial and animal cells (B. Van Houten); nature of the binding of metals to proteins, particularly the iron-binding proteins of blood plasma (R. Woodworth).

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE OR FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Satisfactory score on the Graduate Record Examination including the subject (advanced) portion. In addition:

Year courses in organic chemistry, physical chemistry, and physics (equivalent to Chemistry 141, 142 or 143; 144, Chemistry 162 and Physics 15, 16); quantitative chemistry; mathematics through differential and integral calculus, a year course in a biological science.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE OR FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Under most circumstances, meeting the requirements for admission as stated above will allow advancement to either degree program.

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

Thirty credit hours, 16 of which must be taken from graduate courses offered by the Department of Biochemistry, including Biochemistry 301, 302, 303, 381, and 391 or 392.

Thesis Option

Up to 14 credit hours of Master's Thesis Research (391).

Nonthesis Option

Up to eight credit hours of Independent Literature Research (392).

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

A total of 75 hours, including 20 hours from graduate courses offered by the Department of Biochemistry including Biochemistry 301, 302 or 305-306, 303 and participation throughout residence in Biochemistry Seminars; three hours from graduate courses offered by the Department of Chemistry; ten additional hours from courses in physical or biological sciences; 30 hours of Doctoral Dissertation Research.

COURSES OFFERED

Biochemistry 212, 213, 301-302, 303, 305-306, and 381 are offered annually. Advanced courses are given in alternate years.

212 Biochemistry of Human Disease. Disorders of hemoglobin, iron bilirubin; biochemistry of diabetes, pancreatitis, atherosclerosis, liver and kidney dysfunction; acid-base balance; gene therapy; diagnostic enzymology. *Prerequisites:* Chemistry 42 or 141, Agricultural Biochemistry 201 or permission. Three hours per semester. Hart.

213 Biomedical Biochemistry Laboratory. Introduction to basic principles underlying biochemical analysis in areas of biomedical interest. *Prerequisites:* Concurrent registration in Biochemistry 212 or permission. One hour per semester. Meyer.

301, 302 General Biochemistry, Parts I and II. Survey for science majors. Part I (301): chemistry, structure, metabolism, and function of proteins, carbohydrates, lipids; enzymes, bioenergetics and respiratory processes. Part II (302): amino acids, nucleic acids, protein synthesis, cellular and physiological control mechanisms. *Prerequisites:* Chemistry 141, 142 or 143, 144, and departmental permission. Three hours per semester. Staff.

303 Biochemistry Laboratory. Experimental work designed to demonstrate important principles and to illustrate methods and techniques of modern biochemistry. *Prerequisites:* 301, 302 or 305-306, or concurrent registration therein, and departmental permission. One to four hours. W. Meyer, Coordinator.

305-306 Medical Biochemistry. For medical students. Survey of human physiological, molecular biochemistry; chemistry, metabolism of cellular and dietary constituents; enzymes and bioenergetics; blood, respiration, acid-base balance, mineral metabolism; metabolic controls. *Prerequisites:* Chemistry 141, 142 or 143, 144 or equivalent, and departmental permission. Given on a trimester basis in the

College of Medicine calendar; equivalent to three hours per semester for two semester. Staff.

307, 308 Special Topics in Biochemistry. Areas of biochemistry not treated in concurrent advanced course offerings. Topics include: intermediary metabolism, organic and physical biochemistry, enzymology, physiological chemistry. Two areas are usually covered each semester. *Prerequisites:* 301, 302 or 305-306; Chemistry 162. Two hours per semester. Staff.

320 General Enzymology. General consideration of enzyme nomenclature, purification, assay, introductory kinetics, mechanisms, cofactors, active sites, submit structure, allosteric and regulatory properties, and control of multienzyme systems. *Prerequisites:* 301, 302, or 305-306; Chemistry 162. Three hours. Meyer.

331 Nucleic Acids. The study of structure, composition, organization, function, synthesis, and metabolism of nucleic acids and nucleoprotein particles and matrices in eukaryotic organisms. *Prerequisites:* 301-302, 305-306. Three hours. Cutroneo, Staff.

371 Physical Biochemistry. Protein interaction, solubility and fractionation, electrophoresis, sedimentation, phase rule study, diffusion, viscosity, spectrophotometry, and related topics. *Prerequisites:* 301, 302 or 306; Chemistry 160 or 162. Three hours. Woodworth.

375 Cancer Biology. Overview of cancer biology for health science students. Foundation for cancer research. Lecture format; interdisciplinary viewpoint; outside lectures. *Prerequisites:* 301-302 or 305-306; under special circumstances, 211, 212. Three hours per semester. Chiu.

381 Seminar. A review of recent developments and current literature in the various fields of biochemistry. *Prerequisite:* Departmental permission. One hour per semester.

391 Master's Thesis Research. Credit as arranged.

392 Independent Literature Research. Reading and literature research culminating in a paper on a topic of current interest in biochemistry. Credit as arranged.

491 Doctoral Dissertation Research. Credit as arranged.

Biomedical Engineering

A cooperative program offered by the Department of Computer Science and Electrical Engineering (K. Golden, Chairperson), the Department of Civil Engineering and Mechanical Engineering (J. Beliveau, Interim Chairperson), and the Department of Physiology and Biophysics (N.R. Alpert, Chairperson).

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

An accredited bachelor's degree in an appropriate field.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

An accredited bachelor's degree in electrical or mechanical engineering or equivalent. Courses in biology and chemistry may be recommended as prerequisites. Applicants with backgrounds other than electrical or mechanical engineering will generally be required to make up undergraduate deficiencies.

MINIMUM DEGREE REQUIREMENTS

Physiology and Biophysics 301; 12 hours in electrical or mechanical engineering, physics and mathematics; additional approved courses; thesis research (six to 12 hours) in the Department of Electrical or Mechanical Engineering. Applicants should consult the department to determine if the program offered meets their specific educational objectives.

Biomedical engineering is one of the areas of research interest in the graduate programs in electrical and mechanical engineering.

Biostatistics

This program is administered through the Statistics Program in close collaboration with the faculty and staff of the Medical Biostatistics Unit of the College of Medicine. Dr. Larry Haugh is the program director.

The program offers a concentration in biostatistics leading to the M.S. degree. The curriculum takes full advantage of courses taught in the Statistics Program and includes experience in a variety of health, biomedical, and related research projects in the College of Medicine. This experience is designed to provide candidates with opportunities to use their academic training and work experience in defining research problems, formulating rational methods of inquiry, and gathering, analyzing, and interpreting data. The Medical Biostatistics research activities cover the full range of studies that take place within an academic medicine environment. These include population- based health surveys of various types and evaluations of health promotion programs and professional education activities, such as community intervention studies to prevent adolescent smoking, to enable women to quit smoking and to promote breast cancer screening. They also include clinical studies of disability due to low back pain, bioengineering experiment design and measurement studies, and clinical trials for neurologic diseases, as well as data from other preclinical, clinical and epidemiologic studies. Emphasis is placed on learning to perform computerized data analysis as the statistician in a research team.

Opportunities are also available for biostatistical and biometrical research related to problems in agriculture and the life sciences, as well as natural resources. Collaborating faculty in these areas are available to provide consulting or research experiences. (See also Statistics Program description.)

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES AND ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

An undergraduate major which provides a foundation for the application of statistical methodology and concepts to health and biomedical or agriculture/natural resource problems. In particular, premedicine majors who have delayed their application to medical school will be well suited for the program. It is anticipated that candidates will have completed three semesters of calculus including matrix algebra methods. However, provisional admission to the program can be given prior to the completion of these requirements. Computer experience is desirable. The Graduate Record Examination is strongly advised and is required of any applicant who wishes to be considered for a teaching fellowship or research assistantship.

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

Plan A: (Thesis) A 30-hour degree program, which includes 24 semester hours of approved course work. This must include Biostatistics 200, 221, 223, 231, 241 or 261, 321, 323, other Biostatistics courses numbered above 211, and other quantitative methods courses, plus six semester hours of approved thesis research (391).

Plan B: (Nonthesis) A 33-hour degree program which includes 30 semester hours of approved course work. This must include Biostatistics 200, 221, 223, 231, 241 or 261, 321, 323, other Biostatistics courses numbered above 211, and other quantitative methods courses, and three semester hours of approved statistical research (381).

Under both plans, students must have or acquire a knowledge of the material in Biostatistics 201 and 211, and are expected to participate in the projects of the College of Medicine Biometry Facility as advised, and to attend the regular colloquium series as part of their training. The comprehensive examination covers knowledge acquired in the core courses of the program. During the latter part of their training the students will be expected to take major responsibility for some project, including the presentation of the final report for this project.

COURSES OFFERED

200 Medical Biostatistics. Introductory design and analysis of medical studies. Epidemiological concepts, case-control and cohort studies. Clinical trials. Students evaluate statistical aspects of published health science studies. *Prerequisite:* Statistics 141 or 211 or permission. Three hours. Cross-listing: Statistics 200.

201 Statistical Analysis via Computer. See Statistics 201.

202 Population Dynamics. See Sociology 202.

211,221 Statistical Methods I and II. See Statistics 211, 221.

223 Applied Multivariate Analysis. See Statistics 223.

224 Statistics for Quality and Productivity. See Statistics 224.

225 Applied Regression Analysis. See Statistics 225.

229 Reliability and Survival Analysis. See Statistics 229.

231 Experimental Design. See Statistics 231.

233 Design of Sample Surveys. See Statistics 233.

241 Introduction to Statistical Inference. See Statistics 241.

253 Applied Time Series and Forecasting. See Statistics 253.

254 Sociology of Health and Medicine. See Sociology 254.

261, 262 Statistical Theory I, II. See Statistics 261,262.

321,323,324,325,329 Seminars in Advanced Statistics. See Statistics 321, 323, 324, 325, 329.

381 Statistical Research. See Statistics 281.

385 Consulting Practicum. See Statistics 385.

391 Master's Thesis Research. Credit as arranged.

395 Advanced Topics in Statistics. See Statistics 395.

Botany (BOT)

Professors Barrington (Chairperson), Etherton, Tyree, Ullrich, Worley; Research Associate Professor Lintilhac; Assistant Professor Hoffmann; Research Assistant Professors Cummings, Hughes.

The Botany Department has ongoing research programs in: *ecology and evolution* including physiological ecology of aquatic plants, effects of acid depositions on forest ecosystems, physiological ecology of acid depositions, systematics and evolution of vascular plants, biogeography, bryology, limnology, phycology; *physiology* including morphogenesis and developmental biology of embryonic plant systems, mineral nutrition, growth and development, translocation, cellular electrophysiology, membrane function, amino acid transport, aluminum effects on cell membranes; and *cell and molecular biology* including molecular genetics and recombinant DNA of fungi.

The Botany Department participates actively in the Cell and Molecular Biology Program which provides opportunities for interdisciplinary research with other life science departments.

The Botany Department offers a multidisciplinary non-thesis program leading to the degree of Master of Science, Field Naturalist Option. Enrollment is limited to a small number of mature, highly talented individuals who have demonstrated sustained interest in field aspects of the natural sciences. The program is designed to provide students with: (1) a solid grounding in field-related sciences; (2) the ability to integrate scientific disciplines into a coherent whole at the landscape level; (3) the ability to evaluate sites from a number of perspectives and/or criteria; (4) the ability to translate scientific insights into ecologically sound decisions; and (5) the ability to communicate effectively to a wide range of audiences.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

The equivalent of a UVM major or minor in a natural or physical science. Satisfactory scores on the Verbal and Math sections of the Graduate Record Examination.

MINIMUM DEGREE REQUIREMENTS

A total of 30 credits of course work and thesis research. A minimum of 15 credits of course work should be in botany, other natural sciences, and supporting fields, and at least 9 credits should be in thesis research.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE, FIELD NATURALIST OPTION

An undergraduate or graduate degree in earth or life sciences is expected; additionally, a demonstrated commitment to field sciences (e.g., participation in environmental and conservation organizations, workshops, field trips, research); strong scores on the Graduate Record Examination. A subject (advanced) test in biology or geology is advised for students who lack an undergraduate degree in natural sciences. Recent college graduates are encouraged to pursue interests outside academe before application to the Field Naturalist program.

MINIMUM DEGREE REQUIREMENTS

Thirty credit hours of courses to include at least two courses in each of three core areas: (1) life science; (2) earth science; and (3) ecology, the course selection to be determined by the student's studies committee. Enrollment in the Field Naturalist Practicum (Bot 311) each semester; oral comprehensive examination the fourth semester; written field research project (Bot 392) at the end of the fourth semester.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF ARTS IN TEACHING

The Department offers a program leading to the degree of Master of Arts in Teaching (see page 20). Satisfactory scores on the Graduate Record Examination general (aptitude) section are requirements for acceptance for this degree.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE FOR TEACHERS (BIOLOGY)

A bachelor's degree from an accredited institution and certification as a teacher of biology or an associated field. At least three years of secondary school teaching. Satisfactory scores on the Graduate Record Examinations general (aptitude) section.

MINIMUM DEGREE REQUIREMENTS FOR THE M.S.T. (BIOLOGY)

Thirty hours of course work to include a selection of courses in the Departments of Botany and Zoology which will broaden and balance the undergraduate work in biology. At least two 200-level courses in each department. Courses in four of the five following areas: anatomy; morphology and systematics; genetics; developmental biology; and environmental biology. Up to 12 hours of 100-level courses may be used for the above requirement where approved by the advisor and the Dean. Appropriate courses in related science departments may be used to complete the required 30 hours. No thesis is required; however, each degree recipient must complete a written and oral examination.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

The equivalent of a UVM major or minor in a natural or physical science. Satisfactory scores on the Verbal and Math sections of the Graduate Record Examination.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Completion of one academic year in graduate study at The University of Vermont; completion of the specific language requirement. The candidate must demonstrate ability to comprehend the contents of articles in the biological sciences in a modern foreign language appropriate to the student specialty and approved by the Studies Committee.

MINIMUM DEGREE REQUIREMENTS

A total of 75 credits of course work and dissertation research. A minimum of 40 credits of course work should be in botany, other natural sciences and supporting fields, and at least 20 credits should be in dissertation research. In addition, each candidate must participate in six semester hours of supervised teaching.

COURSES OFFERED

205 Mineral Nutrition of Plants. Role of essential elements for plant growth including classical and modern approaches to the study of ion availability and transport. *Prerequisite:* 104 or equivalent. Three hours. Etherton. Alternate years, 1992–93.

209 Biology of Ferns. Evolutionary biology; a survey of New England ferns and their phylogenetic relationships; current research emphasizing morphological, biogeographical, genetic, and phytochemical aspects of speciation. *Prerequisites:* 108; 132 or 101 recommended or equivalent. Three hours. Barrington. Alternate years, 1993–94.

213 Plant Communities. Plant sociology; structure and organization of the plant community; sampling methods and analysis of data; climatic and edaphic factors; field work. *Prerequisite:* 109 or departmental permission. Three hours. Hughes.

223 Fundamentals of Field Science. Pattern and process in natural systems. Weekly discussions of unifying questions in science with field labs teaching sampling and analysis of vegetation, soils, and animals. *Prerequisites:* Graduate standing; undergraduates with instructor's permission. Three hours. Hughes.

229 Water Relations of Plants. See Forestry 229.

232 Botany Field Trip. Trips to selected environments outside Vermont. Led by several faculty members representing different fields of Botany. Overall, integrated approach to ecology, structure, and function. One hour. Christmas or spring vacation or end of school year.

234 Ecology of Freshwater Algae. Environmental factors influencing distribution and seasonal succession; quantitative methods for estimating standing crop productivity; kinetics of algal growth; competitive and synergistic interactions. *Prerequisite:* 160 or Biology 102 or equivalent. Three hours. Not offered 1992–93.

241 Tropical Plant Systematics. Principles and methods of angiosperm phylogeny. Recent systematic and evolutionary research on flowering plants; survey of tropical flowering plant families. Student presentations on recent research. *Prerequisite:* 109 or equivalent. Four hours. Barrington. Alternate years, 1992–93.

250 Microtechnique. Theory and practice in the preparation of biological materials for anatomical and cytological study, including histochemistry and photomicrography. *Prerequisites:* Introductory chemistry; some knowledge of organic chemistry, anatomy, or cytology is desirable. Three hours. Alternate years, 1993–94.

251 Principles of Light Microscopy. Introduction to the optics, construction and care of the light microscope. Theory of phase and interference contrast, fluorescence and video methods. *Prerequisites:* One year of Physics (6 credits), or permission of instructor. One hour. Lintilhac.

252 Molecular Genetics: Regulation of Gene Expression in Eukaryotes. How cells control the flow of genetic information from gene into active gene product. Distinction between quiescent and active genes, mechanisms of genetic communication/regulation. *Prerequisites:* Biology 101 or Agricultural Biochemistry 201 or Biochemistry 301, or equivalent; others by permission of instructor. Cross-listing: Biology 252, Cell and Molecular Biology 252. Three hours. Ullrich. Alternate years, 1993–94.

254 Genetics of Fungi. Understanding the classicial and molecular genetics of fungi with respect to their contribution in agriculture, basic genetics, biotechnological industry, recombinant DNA and gene expression. *Prerequisites:* Biology 101 or Agricultural Biochemistry 201 or Biochemistry 301, or equivalents; others by permission of instructor. Cross-listing: Cell and Molecular Biology 254. Three hours. Ullrich. Alternate years, 1992–93.

256 Advanced Plant Genetics. Review of major topics in higher plant genetics and cytogenetics. Designed to be applied to the systematics, breeding, and gene engineering of higher plants. *Prerequisite:* 132 or Biology 101 or equivalent. Three hours. Not offered 1992–93.

257 Physiology of the Plant Cell. Detailed study of photosynthesis, plant cell membrane function, and plant cell growth. *Prerequisites:* 104; Chemistry 141, 142 or Chemistry 42; Physics 11, 12 or 31, 42 or equivalents. Four hours. Etherton. Alternate years, 1993–94.

281 Botany Seminar. Presentations of personal research by faculty, graduate students, and outside guest speakers. Attendance required of botany graduate students and seniors in botanical research programs. Without credit.

295 Special Topics. For advanced students within areas of expertise of faculty and staff. Aspects. of ecology, physiology, genetics, cytology, bryology, pteridology, paleobotany, photobiology, membrane physiology, cell biology. *Prerequisite:* Permission of instructor. Credit as arranged.

301 Cell and Molecular Biology. Advanced survey of cell organelles, their composition, origin, and the relationship between their structure and function. Emphasis on recent literature and current controversies. *Prerequisites:* Chemistry 142, graduate standing in biology or permission of instructor. Three hours. Cross-listing: Cell and Molecular Biology 301.

311 Field Naturalist Practicum. Landscape analysis; planning and designing field projects; integrated problem solving. *Prerequisites:* Enrollment in the Field Naturalist program. Variable hours up to three.

381 Selected Problems in Modern Botany. Subject matter varies but will stress recent botanical inquiries, particularly where they border on mathematics, physics, and chemistry. *Prerequisite:* Departmental permission. One to three hours.

391 Master's Thesis Research. Credit as arranged.

392 Master's Project Research. Credit as arranged.

491 Doctoral Dissertation Research. Credit as arranged.

Business Administration (BSAD)

Professors Brandenburg (Dean), Grinnell, Laber, Savitt, Shirland, Thimm; Associate Professors Averyt, Cats-Baril, Gatti, Gurdon, Hunt, Jesse, Kraushaar, McIntosh, Parke, Sinkula, Tashman; Assistant Professors Battelle, Clark, Dempsey, Noordewier, Thompson, Wilson.

Management is the art of applying principles of the mathematical and social sciences to decision making in an organizational environment characterized by uncertainty and limited resources. The program is designed (1) to develop the individual's ability to practice the art and (2) to build a foundation that will facilitate and encourage the continuation of this development beyond a formal university setting. Courses in the program emphasize the understanding and critical evaluation of conceptual and theoretical principles relevant to the decision process in the functional areas of business.

Upon completion of the program, students will have been exposed to each functional area, will have been required to demonstrate an ability to engage in individual and group research projects, and will have demonstrated capacity to present coherently and defend their views orally and in writing.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES AND FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION

The MBA program consists of Prerequisite, First-Year, and Second-Year courses. Equivalent undergraduate course work can be used to satisfy prerequisites. A student can be admitted to the Graduate College prior to the successful completion of prerequisites. However, prerequisites must be successfully completed before a student is admitted to candidacy for the MBA degree. Enrollment in First- and Second-Year courses is restricted to students who have been accepted for admission to the Graduate College.

All applicants must meet the general requirements for admission to the Graduate College. In addition to transcripts of prior undergraduate and graduate training, the applicant is required to submit scores on the Graduate Management Admissions Test. (GMAT scores are accepted in lieu of Graduate Record Examination scores for financial assistance in this program.) To determine high promise of success in the MBA Program, an evaluation is made of the following: previous academic performance, satisfactory scores on the GMAT, relevant work experience, writing ability, and recommendations.

The MBA program is accredited by the American Assembly of Collegiate Schools of Business.

MINIMUM DEGREE REQUIREMENTS

Students must complete all of the courses listed. Prerequisite courses must be completed before enrollment in any First-Year courses. Successful completion of a comprehensive case analysis (CCA) is also required. The CCA is administered as a component of BSAD 396, Business Policy.

Prerequisite Courses

(Equivalent UVM courses shown in parentheses)

Principles of Economics (Economics 11, 12)	6.0 hours
Calculus (Math. 19)	3.0
Computer Programming (Computer Science 11)	3.0
	12.0 hours

First-Year Courses

BSAD 304 Managerial Economics	3.0 hours
BSAD 305 Fundamentals of Marketing Management	3.0
BSAD 306 Financial Accounting	3.0
BSAD 307 Organization and Management Studies	3.0
BSAD 308 Corporate Finance	3.0
BSAD 309 Fundamentals of Legal Environment of Business	3.0
BSAD 313 Statistical Analysis for Management	3.0
BSAD 365 Management Accounting	3.0
	24.0 hours

Second-Year Courses

BSAD 340 Production and Operations Management	3.0 hours
BSAD 345 Management Information Systems	3.0
BSAD 375 Organizational Theory	3.0
BSAD 380 Managerial Finance	3.0
BSAD 396 Business Policy	3.0
Three 300-Level Elective Courses	9.0
	24.0 hours

The First-Year and Second-Year course groupings imply a course load for a full-time student of 12 credits per semester. Part-time students typically will enroll in six credits of course work per semester. Normally, First-Year courses will be completed before enrollment in Second-Year courses. All students are required to complete at least one graduate-level course in applied quantitative methods (QM). This requirement may be met by taking BSAD 313 or an alternative, approved QM course.

Certain First-Year courses may be waived in the event of previous academic work and/or successful completion of a qualifying examination. Depending on the particular course waived, replacement by an appropriate 300-level elective course may be required. A minimum of 30 hours of 300-level credits must be completed at UVM for the MBA degree.

COURSES OFFERED

304 Managerial Economics. Application of economic, mathematical, and statistical models to managerial decision making. Emphasis given to optimization techniques, spreadsheet analyses, decision trees, and cost/benefit analysis. *Prerequisites:* MBA standing, concurrent enrollment in 313. Three hours.

305 Fundamentals of Marketing Management. Accelerated course on marketing principles and theory. Analytical approach to study of product pricing strategies; distribution, communication, and promotion; consumer behavior and development of corporate marketing strategy. *Prerequisite:* MBA standing. Three hours.

306 Financial Accounting. Introduction to basic concepts, assumptions, conventions providing foundation for developing financial statements. Analysis, interpretation of the income statement, balance sheet, statement of changes in financial position. *Prerequisite:* MBA standing. Three hours.

307 Organization and Management Studies. A survey course of the principles of management and organization behavior. The fundamentals of planning, organizing, leading, staffing, and controlling are covered. Particular attention is given to organization theory and behavior, including topics such as motivation, group behavior and decision making. All areas are covered in an international context. *Prerequisite:* MBA standing. Three hours.

308 Corporate Finance. An introduction to financial decision making in the firm. Decisions related to acquisition and allocation of funds are examined and practiced through cases and problems. *Prerequisites:* MBA standing, 306. Three hours.

309 Fundamentals of Legal Environment of Business. General overview of areas of interaction between businesses and governments. Examination of governmental policy toward business and review of laws governing business-government interactions. *Prerequisite:* MBA standing. Three hours.

313 Statistical Analysis for Management. Data analysis and communication of statistical information for managerial decision making. Methods of modeling relationships, comparing strategies, and assessing probabilities. Instruction in computer use. *Prerequisite:* MBA standing. Three hours.

340 Production and Operations Management. Study of the operations function in manufacturing and service organizations. Design, planning, and control are examined, with emphasis on managerial analysis and decision making. *Prerequisite:* MBA standing, 313. Three hours.

341 Forecasting. Modern forecasting methods and practices including smoothing, regression, econometric and Box-Jenkins models; combining forecasts and forecasting simulations. Professional software used for developing forecasts. *Prerequisite:* MBA standing, 313 or equivalent. Three hours.

342 Operations Research Models and Concepts. Concepts and models of operations research as applied to the business environment. Emphasis on modeling and using solution results for managerial decision making. Extensive computer use required. *Prerequisites:* MBA standing, 304. Three hours.

345 Management Information Systems. An introduction to the design and implementation of management information systems. A theoretical framework is developed and applied by students to an information system. *Prerequisite:* MBA standing. Three hours.

347 Analysis of Decision Support Systems. Normative guidelines to design, implement, and evaluate information systems that support unstructured managerial tasks. The guidelines are developed by analyzing information distortion in organizations. *Prerequisites:* MBA standing, 307, 345. Three hours.

359 Marketing Policy. Concepts from quantitative methods, economics, behavioral sciences applied to marketing management. Includes: marketing opportunities, organizing for marketing, planning marketing programs, control of marketing effort. Case book method. *Prerequisite:* MBA standing, 305. Three hours.

360 Contemporary Financial Accounting and Reporting. Current financial accounting, reporting practices; focus on contemporary issues, problems. Impact of pronouncements of Accounting Principles Board, Financial Accounting Standards Board, Securities and Exchange Commission, and other bodies. *Prerequisite:* MBA standing, 306. Three hours.

365 Management Accounting. Study of development, utilization of accounting information for product costing and pricing purposes, for routine planning and control of organizational activities, for decision-making purposes. *Prerequisite:* MBA standing, 306. Three hours.

371 Personnel Administration. Critical examination of contemporary problems, controversies in personnel administration. Current issues, topics (affirmative action, discrimination in employment) covered with more traditional topics of wage and salary administration, etc. *Prerequisite:* MBA standing, 307. Three hours.

375 Organization Theory. Organization theories examined for insights into behaviors of organizations and their members. Open systems perspective. Identification of contingencies in organization design based on human, structural, technological, environmental variables. *Prerequisite:* MBA standing, 307. Three hours.

376 The Management of Change In Organizations. Applied behavioral science perspective adopted to identify conceptual issues, develop diagnostic skills, examine alternative intervention strategies relevant to accomplishment of planned changes in organizational systems. *Prerequisite:* MBA standing, 307. Three hours.

379 Strategic Management. Case studies of existing organizations are used to illustrate the intellectual, social processes of adaptation to a changing environment; strategy formulation, implementation. Not offered every year. *Prerequisites:* MBA standing, completion of First-Year courses. Three hours.

380 Managerial Finance. Focus on key financial decisions that affect the value of the firms. Topics: capital structure, leasing, mergers and acquisitions, capital market theories and evidence. *Prerequisites:* MBA standing, 308. Three hours.

382 Investment and Portfolio Analysis. Examination of the investment decision process. Specific topics include operations of equity securities markets, market efficiency, capital asset pricing model, and portfolio management. *Prerequisites:* MBA standing, 308. Three hours.

384 Financial Markets and Interest Rates. Study of level and structure of interest rates. Topics: flow of funds accounting, market vs. natural rate of interest, interest rate structure, behavior of interest rates over business cycle. *Prerequisites:* MBA standing, 308. Three hours.

394 Independent Readings and Research. Allows a student to pursue independent research under the direction of a faculty member. Normally, the course will include a research paper. *Prerequisites:* MBA standing, permission of the Graduate Studies Committee. One to three hours.

395 Special Topics. Topics and material that may develop later into a regular course offering; in addition, it may include topics and material offered only once. *Prerequisites:* MBA standing, permission of the Graduate Studies Committee. One to three hours.

396 Business Policy. A case course focusing on the resolution of complex cases involving simultaneous solutions of problems in two or more functional areas. *Prerequisites:* MBA standing; last semester of study. Three hours.

Cell and Molecular Biology (Interdisciplinary)

Participating faculty are from the following departments: Anatomy and Neurobiology; Botany; Biochemistry; Civil Engineering; Medicine; Microbiology; Neurology; Obstetrics and Gynecology; Pathology; Pediatrics; Pharmacology; Physics; Physiology and Biophysics; Psychiatry; Zoology.

An interdisciplinary program leading to M.S. and Ph.D. degrees in Cell and Molecular Biology is offered under the direction of a committee composed of faculty members drawn from the participating departments. The program provides the flexibility necessary for students to gain competence in the area of their choice. The extensive research facilities of the participating departments are available to all graduate students enrolled in the program. Inquiries should be directed to the Cell and Molecular Biology Program Director Judith Van Houten, Department of Zoology.

Research includes: (Absher) cellular aging and cellular mechanisms of pulmonary fibrosis; (Albertini) human somatic-cell genetic mutations, histocompatability genetics; (Auletta) prostaglandins and parturition; (Bateman) Gene expression; (Brass) regulation of neuroendocrine peptides and receptors; signal transduction; (Budd) T-lymphocyte development in autoimmune mice; (Burke) RNA splicing, biological catalysis by RNA; (Chiu) regulation of gene activities in developing and neoplastic tissues; (Church) structure and function of blood coagulation proteins; (Cornbrooks) nervous system development and regeneration; (Crabb) protein chemistry, peptide synthesis and sequencing, molecular biology of visual cycle proteins; (Craighead) pathogenesis of viral infections; mineral lung disease; (Currier) cell — cell interactions in plant-microbe symbiosis; (Danforth) diet composition and energy expenditure; (Davis); (Ellis) regulation of neuronal receptors and second messengers; (Dolci); (Etherton) metals and plant membranes; (Forehand); (Francklyn); (Gannon) susceptibility of vascular endothelium to oxidant-mediated injury; (Gilmartin) RNA processing and its role in the regulation of gene expression; (Grant) hematopoiesis; (Hacker) cellular and immunologic consequences of chemotherapeutic drugs; (Haeberle) molecular regulation of cell motility and muscle contraction; (Happ) hormonal control of differentiation in insects; (Hart) metal toxicity in the lung; (Hayashi) early T-cell development, regulation of thymic endocrine epithelial cells and bone marrow lymphoid progenitor cells; (Heintz) protein-DNA interactions at eucaryotic origins of replication; control of the eucaryotic cell cycle; (Hemenway) surface properties and biological effects of minerals (Horton) diabetes, exercise, and intermediary metabolism; (Huber) immune mechanisms of tissue damage in viral infections; (Jaken) signal transduction through protein kinase C; (Johnson) control of cell polarity in yeast; (Jones); (Kelleher) control of protein synthesis in mammalian cells, oncodevelopmental genes; (Kelley) growth factor/cytokine involvement in proliferation and protein/connective tissue turnover; (Kow); (Kurjan) cell-cell interactions involved in yeast mating; (Landesman) morphology and biochemistry of amphibian limb regeneration; (Lannigan); (Lenox) regulation of receptor coupled second and third messenger systems in brain and neuronal cells, mechanism of action lithium in the brain; (Leslie) matrix remodeling after viral infections; (Long) structure and function of blood proteins; (Low) cell biology of tissue remodeling; (Macara); (Mann) biochemistry of blood coagulation; (Maughan) molecular mechanisms of muscle contraction and protein assembly in Drosophila; (Mawe); (May) regulation of neuropeptide expression; molecular endocrinology; (McKeehan) vascular, prostate, and liver cell biology; (Meyer) enzymology of protein kinases and nucleases; (Mitchell); (Moehring) biochemical and molecular genetics of microbial toxin action and virus replication; (Morrical); (Mossman) carcinogenesis of tracheobronchial tree, pulmonary fibrosis; (Nicklas) molecular genetics of human mutation, human gene mappling; (Novotny) molecular genetics of development in fungi; (Otter) control of flagellar movement, calmodulin, other Ca2+ binding proteins; (Parsons) synaptic physiology and pharmacology, mechanisms of transmitter interactions at autonomic neurons; nicotinic activation and inactivation at the motor end plate; (Pederson) assembly and function of transcription complexes in chromatin; (Periasamy) gene expression in muscle; (Pratt) role of DNA methylation in regulation of gene expression; (Raper) molecular genetics of development in a lower eukaryote; (Roberts) cellular pharmacology of anticancer agents; (Sachs); (G. Sato) serum-free cell culture, cellular endocrinology; (J.D. Sato) monoclonal antibodies to growth factor receptors and growth factor action; (Schaeffer) maintenance and induction of the carcinogenic state; (Serrero) hormonal control and gene expression of adipose differentiation at the cellular and molecular levels; (Shatos); (Shreeve) biochemistry and molecular pharmacology of receptors; (Sriram) immunoregulation; (Stevens) cellular and molecular biology of tissue damage by toxic chemicals and its repair; (Taatjes) glycosylation reactions in the Golgi apparatus, immunocytochemistry; (P. Tracy) cellular interactions with coagulation proteins as related to hemostasis and thrombosis; (R. Tracy) relationship of coagulation to heart disease; (Tritton) membrane alterations induced by chemotherapeutic and toxic agents; (Ullrich) mating-type regulation of gene expression in fungi; (B. Van Houten) molecular biology of DNA repair; (J. Van Houten) genetic analysis of chemosensory transduction in Paramecium; (Vigoreaux); (Wallace) biological consequences of oxidative DNA damage, DNA repair; (Warshaw) molecular basis of muscle contraction; (Weaver) DNA content and cell-cycle kinetics of neoplasia; (Wilson) developmental genetics of juvenile hormone regulation and oogenesis in Drosophila; (Woodcock-Mitchell); (Woodworth) biochemistry of ion-binding and ion-transport proteins; cellular ion metabolism; (Wu).

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE AND FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Biology (three semesters, including genetics), chemistry through organic, mathematics through calculus, physics (two semesters). Satisfactory scores (60 percentile) on general (aptitude) Graduate Record Examination. Students who do not have all of the courses listed but who have a good academic record will be considered for admission to the program. Deficiencies may be made up after matriculation.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

Completion of any deficient admission requirements.

MINIMUM REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

Thirty hours of graduate level credit including Cell Biology 301–302 and one course in each of the following areas: genetics, biochemistry (one year); a techniques course approved by the Studies Committee; cell biology seminar each semester; thesis research.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Minimum of one semester of Physical Chemistry, equivalent to Chemistry 160. Completion of any deficient admission requirements.

MINIMUM REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Cell Biology 301-302, one course in each of the three following areas: genetics, biochemistry (one year), and techniques course approved by the Studies Committee; a minimum of 11 additional hours of course work. Studies Committee will advise course selection. Dissertation research, minimum 20 credits. All students must demonstrate satisfactory progress: finish minimum course work within three years; finish cumulative exam within prescribed time limits; participate in seminar program.

The expected sequence for all first year students in the fall is CLBI 301, biochemistry, CLBI 381, and CLBI 391 or 491; in the spring is CLBI 302 (or other relevant course in years CLBI 302 is not offered), biochemistry, CLBI 381 and CLBI 391 or 491. Additional courses or substitutions are offered with flexibility, but must have permission of the Program Director.

COURSES OFFERED

295 Special Topics. Credit as arranged.

301 Cell Biology. Advanced survey of cell organelles, their composition, origin, and the relationship between their structure and function. Emphasis on recent literature and current controversies. *Prerequisites:* Chemistry 142, graduate standing in biology or permission of instructor. Three hours.

302 Specialized Cells and Cell Processes. Current issues and research in the field of plant, invertebrate, mammalian cell, and molecular biology. *Prerequisite:* Cell Biology 301. Three hours. Also offered through W. A. Jones Cell Science Center.

381 Seminar. One hour. Staff.

391 Master's Thesis Research. Credit as arranged.

491 Doctoral Dissertation Research. Credit as arranged.

Chemistry (CHEM)

Professors Allen, Bushweller (Chairperson), Flanagan, Geiger, Jewett, Krapcho, Kuehne, Strauss, White; Associate Professors Goldberg, Leenstra, Weltin; Assistant Professors Ahmed, Rosenthal, Sentell; Research Associate Professor Farrell.

Current research in organic chemistry includes dynamic NMR studies of intramolecular stereodynamics, syntheses of medicinally valuable natural products, isolation and structure determination of natural products, studies of the stereochemistry of C-alkylation of α-anions, decarboxylation of geminal diesters, biomimetic syntheses, preparation of benzomorphans and their analogues which have chemotherapeutic potential, synthesis and reactions of hybrid organic-inorganic polymers, and mechanistic studies of organic chemical reactions.

Physical chemistry research projects include hydrogen absorption by metals, alloys, and intermetallic compounds with a view toward storage of hydrogen as a fuel, theoretical studies of the electronic structure of chemical bonds in small molecules using *ab initio* variation calculations, chemical thermodynamics, statistical mechanical modeling of chemical systems, and the use of various types of molecular spectroscopy, such as fluorescence, magnetic resonance, and IR/Raman, to address questions of structure, bonding, and dynamics in chemical and biophysical systems.

Research in inorganic chemistry includes investigations of the syntheses, structure, and spectroscopic properties of main-group ring systems and polymers with an emphasis on phosphazenes and borazines, electrochemical control of the structure and reactivity of transition metal complexes, solid state chemistry with an emphasis on the use of intercalation properties of layered solids to tailor the reactivity and electronic properties of inorganic substrates, synthesis of new organometallic compounds with technologically significant properties, solid state structure by x-ray diffraction, dynamic NMR studies of the stereodynamics of various metal-phosphine complexes, and organotransition metal chemistry.

Research in analytical chemistry includes electrochemical studies of transition metal complexes and organometallic complexes, electron spin resonance studies of materials in unusual oxidation states, novel reactions of reactive compounds generated electrochemically under high vacuum, studies of factors influencing heterogeneous electron transfer process in nonaqueous media, studies of transient, imploding plasmas as solid sample atomizers for atomic spectroscopy, the development of instrumentation and techniques suitable for the direct localized and bulk trace elemental analysis of nonconducting solid samples via atomic spectrometry, and studies of retention mechanisms in reversed phase and micellar liquid chromatography.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE FOR TEACHERS (PHYSICAL SCIENCES)

An undergraduate major in an appropriate field. Satisfactory scores on the general (aptitude) Graduate Record Examination. Completion of at least one full year of teaching.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE FOR TEACHERS (PHYSICAL SCIENCES)

Successful completion of Physics 128, Chemistry 141 and 162, and Mathematics 121, or their equivalents. (These courses may have been taken at the undergraduate level, as part of this graduate program, or credit may be obtained by transfer or examination.)

A program is also offered leading to the degree of Master of Arts in Teaching (see page 20).

MINIMUM REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE FOR TEACHERS (PHYSICAL SCIENCES)

The above prerequisites for admission to candidacy must be supplemented by: (1) completion of 30 hours of credit, of which at least 18 must be in Physical Sciences Option (A) or (B) as described below. The remaining 12 credits may be chosen, with the consent of the Joint Advisory Committee, from appropriate courses above 100 in science, engineering, mathematics, and education (credit in education courses is limited to six semester hours); (2) successful completion of a comprehensive examination administered by the Joint Advisory Committee.

Physical Sciences Option (A): Nine semester hours of Physics numbered 128 and above, Chemistry 231 and six semester hours of Chemistry chosen from Chemistry 163, 232, 201, 264, and 241. This option is primarily for teachers of chemistry.

Physical Sciences Option (B): nine semester hours of Chemistry numbered 141 and above and nine hours of Physics in courses numbered above 200. This option is primarily for teachers of physics.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

An undergraduate major in an appropriate field. Satisfac-

tory scores on the Graduate Record Examination general (aptitude) section for those requesting financial assistance.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

The requirements for admission to candidacy for the Master of Science degree are: (1) proficiency in three areas of chemistry evidenced by the biannual qualifying examinations or completion of designated courses at this university; (2) one semester of residence; (3) at least 15 hours of formal course work including (a) six hours of graduate-level courses in the chemical field of specialization, (b) three hours of graduate-level chemistry courses not in the area of concentration, (c) Chemistry 386 (only for those electing Plan A), and (d) Chemistry 381 (Seminar), and (4) maintenance of an overall point-hour ratio of 3.00. Students studying in the Master of Science degree program are advised to take the cumulative examinations in their specialty.

MINIMUM REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

The above prerequisites for admission to candidacy must be supplemented in either of the following two ways:

Plan A: Completion of 12 hours of Masters Thesis Research (Chemistry 391) and submission of a satisfactory thesis; (2) completion of at least 30 hours of graduate credit (courses and Masters Thesis Research); and (3) one additional hour of Chemistry 381 (Seminar).

Plan B: Completion of six hours of Independent Literature Research Project (Chemistry 395); (2) completion of at least 30 hours of graduate credit (courses and Literature Research Project); and (3) one additional hour of Chemistry 381 (Seminar).

M.S. students should decide at the beginning of their program whether they will pursue Option A or Option B and inform the Department and Graduate College of their decisions.

A reading knowledge of German is also required.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

An undergraduate major in an appropriate field. Satisfactory scores on the Graduate Record Examination general (aptitude) section for those requesting financial assistance.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

It is expected that a student will ordinarily complete the following requirements for admission to candidacy by the end of the second year of residence: (1) at least 15 hours of research (Chemistry 491); (2) satisfactory performance in the cumulative examinations in the specialty field; (3) demonstration of basic competence in four fields of chemistry (analytical, inorganic, organic, and physical) through the biannual qualifying examinations or completion of prescribed courses at The University of Vermont; (4) three hours of teaching; (5) one year of residence; (6) the following courses are required: Chemistry 386 (two credits) and 381 (two credits), three semester hours of credit of advanced level work in three of the four areas of chemistry (analytical, inorganic, organic, and physical). The remainder of each student's program will be determined by a departmental studies committee on the basis of qualifying examination performance, background, and research interests. In the normal course of events a student should expect to devote much of the first year to formal course work; (7) maintenance of an overall point-hour ratio of 3.25.

MINIMUM REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

In addition to the above requirements a student must: (1) complete a doctoral research project, write an acceptable dissertation, and defend it; (2) present a total of 75 hours of credit in course work and dissertation research, and (3) make an oral and written presentation of an original research proposal, Chemistry 388 (at least six months prior to the submission of the dissertation). The student must also demonstrate a reading knowledge of scientific German and of either French, Russian, or computer programming.

COURSES OFFERED

Prerequisites for all courses: as listed, or equivalent, or by permission of instructor.

201 Advanced Chemistry Laboratory (1-6). Laboratory and discussion only. Laboratory problems requiring modern analytical, physical, and inorganic synthetic techniques. *Prerequisites:* 146, 221, credit for or concurrent enrollment in 162 or 163. Three hours.

202 Advanced Chemistry Laboratory (0-6). Laboratory only. Laboratory problems requiring modern analytical, physical, and inorganic synthetic techniques. *Prerequisite:* 201. Two hours.

214 Polymer Chemistry. Polymer size and weight distribution. Kinetic models for step polymerization, addition polymerization, copolymerization. Physical properties, characterization of polymers in the solid state and in solution. *Prerequisites:* 142 or 144, 162. Three hours. Allen.

221 Instrumental Analysis. Systematic survey of modern methods of chemical analysis. Fundamental principles and applications of spectroscopy, electrochemistry, and separation techniques. *Prerequisites:* Credit for or concurrent enrollment in 162 or 163. Three hours. Geiger, Goldberg, Sentell.

222 Advanced Analytical Chemistry. In-depth coverage of selected modern instrumental methods of chemical analysis, emphasizing most recent developments in spectroscopy, electrochemistry, and separation techniques. *Prerequisite:* 221. Three hours. Geiger, Goldberg, Sentell.

224 Chemical Separations. Theory and practice of chromatographic separations. Emphasis on gas-liquid, liquid-liquid, and liquid-solid chromatography. *Prerequisite:* 221. Three hours. Sentell.

225 Electroanalytical Chemistry. Principles of modern electrochemical analysis, mainly finite current methods — voltammetry, polarography, chronoamperometry, cyclic voltammetry, double layer theory, electron transfer kinetics. Three hours. Geiger.

226 Analytical Spectroscopy. Principles of optical spectroscopic methods of analysis. Emphasis on theory and practice of atomic spectroscopy and new molecular spectroscopic methods. *Prerequisite:* 221. Three hours. Goldberg.

227, 228 Special Topics in Analytical Chemistry. Selected topics of current interest in the area of analytical chemistry. New techniques and methodologies, especially in chemical instrumentation. Credit as arranged. Geiger, Goldberg, Sentell.

231 Inorganic Chemistry. Survey of inorganic systems. Symmetry, group theory, structure, bonding, acid-base chemistry, crystal field theory. Chemistry of solid state, ionic, covalent and electron deficient systems. *Prerequisite:* 162. Three hours. Ahmed, Allen, Rosenthal.

232 Advanced Inorganic Chemistry. Ligand field and molecular orbital theories applied to transition metal com-

plexes, introduction to organometallic chemistry, inorganic reaction mechanisms, bioinorganic chemistry. *Prerequisite:* 231. Three hours. Ahmed, Allen, Rosenthal.

234 Organometallic Chemistry. Systematic survey of syntheses, properties, structures, bonding, reactions of both main group and transition series organometallic compounds. Variation of structure and stability of metal-carbon bond throughout periodic system. *Prerequisite:* 231. Three hours. Ahmed, Allen.

236 Physical Inorganic Chemistry. Fundamental physical basis for spectroscopic techniques, other observable phenomena important to inorganic chemistry. Topics: ligand field theory, magnetism, magnetic resonance, Mossbauer spectroscopy, optical activity. *Prerequisites:* 163, 231. Three hours. Ahmed, Allen, Rosenthal.

237, 238 Special Topics in Inorganic Chemistry. Areas of current interest involving inorganic systems such as bioinorganic, solid state and polymers with unusual properties. Credit as arranged. Ahmed, Allen, Rosenthal.

241 Advanced Organic Chemistry. Stereochemistry, reactivity criteria, reaction mechanisms and synthetic methods are stressed. Reactive intermediates such as carbanions, carbocations, carbenes, and free radicals are used to systematize mechanistic discussions. *Prerequisites:* 142 or 144, 162. Three hours. Krapcho, Kuehne, Strauss, White.

242 Advanced Organic Chemistry. Mechanistic considerations of reactions which include enolates, additions (such as cyloadditions, hydroborations, etc.), annelations, oxidations, rearrangements, eliminations, and approaches to multistep syntheses. *Prerequisites:* 241. Three hours. Krapcho, Kuehne, Strauss.

251 Physical Organic Chemistry. Structure-reactivity relationships, molecular properties and their interpretation. Methods and results of investigations of mechanisms of common organic reactions. *Prerequisites:* 142 or 144, 162. Three hours. Jewett, White.

253 Practical NMR Spectroscopy. Introduction to high resolution pulsed Fourier transform nuclear magnetic resonance spectroscopy. Chemical shifts, scalar coupling, relaxation, molecular symmetry considerations, chemical exchange effects. *Prerequisites:* 142 or 144, 163. Three hours. Bushweller.

257, 258 Special Topics in Organic Chemistry. Advanced level discussion of specific topics in organic chemistry of current interest such as photochemistry, carbenes, bioorganic chemistry, magnetic resonance, etc. Credit as arranged. Bushweller, Jewett, Krapcho, Kuehne, Strauss, White.

262 Chemical Thermodynamics. Systematic study of the application of thermodynamics to chemical problems. Concepts of statistical thermodynamics introduced. *Prerequisites:* 162, 163. Three hours. Flanagan.

263 Introduction to Quantum Mechanics. General consideration of quantum mechanics. Development of techniques pertinent to the application of quantum mechanics to chemical problems. *Prerequisites:* 163. Three hours. Weltin.

264 Fundamentals of Spectroscopy. In-depth discussion of the theory of molecular states and transitions between them, with applications to electronic spectroscopy. Explicit treatment of vibrations in molecules. *Prerequisites:* 163, Math 121. Three hours. Leenstra.

265 Statistical Mechanics. Development of statistical mechanics and its application to problems of chemical interest. *Prerequisites:* 162, 163; 263 recommended. Three hours. Flanagan.

267, 268 Special Topics in Physical Chemistry. Advanced discussion of physical chemistry and chemical physics, group theory, solid state, molecular orbital theory, irreversible thermodynamics, kinetics and mechanisms, solution theory, calculations, spectroscopy. Credit as arranged. Flanagan, Leenstra, Weltin.

285, 286 Special Topics. Selected topics of an interdisciplinary nature, designed particularly for advanced undergraduate chemistry majors. Possible subjects include environmental chemistry, chemical technology, chemical economics. Offered as occasions arise. Variable credit.

342 Natural Products — The Alkaloids. The major classes of alkaloids surveyed from a biogenetic point of view. Classical and modern degradation methods, total syntheses and biosynthetic incorporation of labeled compounds. *Prerequisite:* Credit or concurrent enrollment in 242. Three hours. Alternate years. Kuehne.

344 Natural Products — The Terpenes. The chemistry of mono, sesqui, di and triterpenes, including degradations, structure proofs, total syntheses, rearrangement reactions, and biogenesis. *Prerequisite:* Credit or concurrent enrollment in 242. Three hours. Alternate years. Kuehne.

363 Quantum Chemistry. Applications of quantum mechanical techniques to problems of chemical interest. *Prerequisite:* 263. Three hours. Offered as occasion warrants. Weltin.

381, 382 Seminar. Current problems and literature. One hour.

386 Methods of Chemical Investigation. Introduction to advanced modern chemical methods. *Prerequisite:* Permission of department. Two hours.

388 Research Problem Conception and Solution. Independent origination of research problems and the methods of their solution. Required of all doctoral candidates. *Prerequisite:* Permission of department. This course shall be completed at least six months in advance of the Ph.D. dissertation defense, and in no case later than the end of the seventh semester of graduate studies at UVM. One hour.

391 Master's Thesis Research. Credit as arranged.

395 Independent Literature Research Project. Reading and literature research culminating in the preparation of a comprehensive and critical review of a topic of current interest in chemistry. Credit as arranged.

491 Doctoral Dissertation Research. Credit as arranged.

Civil Engineering (CE)

Professors Beliveau (Chairperson), Cassell, Dawson, Hemenway, Oppenlander, Pinder; Associate Professors Downer, Laible, Olson; Assistant Professors Dougherty (Graduate Coordinator), Hayden; Adjunct Professor Knight.

Graduate programs in Civil Engineering that lead to the Master of Science and Doctor of Philosophy degrees are offered. The curricular and research programs emphasize engineering related to environmental issues; in addition, biomechanical, structural, geotechnical, and transportation studies are possible.

Research includes groundwater pollution and optimal remediation design, indoor air pollution and related health effects, computational methods for high-performance computers, circulation and contaminant transport in lakes and estuaries, environmental restoration, hazardous waste management and landfill siting, mathematical modeling of chemical and mechanical processes in the spine, and dynamic behavior of structures.

Generally, enrollment in the Ph.D. program is limited to full-time students.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

A bachelor's degree and the approval of this Department. Satisfactory scores on the Graduate Record Examination general (aptitude) section. International students whose native language is not English or who have not received their education in English are required to submit satisfactory results from the TOEFL examination.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

Specific course work may be required of those who lack a sufficiently strong engineering background.

MINIMUM DEGREE REQUIREMENTS

The above requirements for advancement to candidacy must be supplemented in either of the two following ways:

Plan A: Completion of advanced courses in civil engineering, mathematics, and other approved disciplines and the completion of an acceptable Master's thesis. At least 30 hours must be accumulated, 6 to 9 of them in thesis research.

Plan B: Completion of 30 hours of advanced courses in civil engineering, mathematics, and other approved disciplines.

Students must declare which option they intend to pursue at the beginning of their program.

MASTER OF SCIENCE IN WATER RESOURCES

A Master of Science in Water Resources administered by the School of Natural Resources is also available. The program is established with an interdisciplinary faculty from Natural Resources, Geology, and Civil Engineering. See the section entitled Water Resources for more information.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

An undergraduate degree in an appropriate field of study and demonstrated academic performance as measured by grades and satisfactory scores on the Graduate Record Examination general (aptitude) section. Applicants whose native language is not English or who have not received their education in English must present satisfactory results from the TOEFL examination.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

It is ordinarily expected that a student will complete the following requirements for advancement to candidacy prior to the end of the second year in the program: (1) one year of residency at UVM; (2) teaching experience in one course; (3) at least 12 credit hours of research; (4) at least 15 credit hours of coursework at the graduate level acceptable to the student's Studies Committee; (5) satisfactory performance on a comprehensive examination that includes a written part and an oral part; and (6) satisfactory record of performance in courses and in teaching and research assignments.

MINIMUM REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

In addition to advancement to candidacy, the student must (1) present at least 75 credit hours in approved coursework and research (including those required for advancement to candidacy), of which at least 35 credit hours are in research and 6 credit hours are in coursework in disciplines ancillary to Civil Engineering; and (2) write and successfully defend an acceptable dissertation.

COURSES OFFERED

210 Airphoto Interpretation. Aerial photographic interpretation; principles of stereoscopic viewing, identification of airphoto features related to landform, vegetation, drainage, soils, topography; use of airphoto interpretation in soil identification. Three hours. Olson.

220 Introduction to Finite Element Analysis. Introduction to finite element analysis; applications in solid mechanics, hydrodynamics, and transport; analysis of model behavior; Fourier analysis. Computer project required. *Prerequisites:* Computer programming, linear algebra, and PDE's, or permission of instructor. Three hours.

230 Community Planning Techniques. Size, spacing, and functions of cities; economic, social, and physical determinants of land-use elements; studies for urban planning; and the process of land-use planning. Three hours. Oppenlander.

248 Hazardous Waste Management Engineering. Managing industrial and hazardous wastes from generation to disposal. Waste minimization, recovery, and treatment technologies; transportation, disposal, legal considerations; hazardous waste site remediation. Design projects. *Prerequisite:* Permission. Three hours.

250 Environmental Facilities Design — Water. Design of water supply systems including: source evaluation, transmission, distribution; water treatment plant design; equipment selection, and wells. *Prerequisite:* 151 or equivalent. Three hours.

251 Environmental Facilities Design — Wastewater. Design wastewater conveyance and treatment facilities; sewage-treatment plant design, and equipment selection. *Prerequisite:* 151 or equivalent. Three hours.

252 Industrial Hygiene. Industrial hygiene problems; effects of pollutants on health; threshold limit values, and emphasis on the engineering, evaluation of the hazard and control techniques. *Prerequisites:* Chemistry 5 and Physics 25 or equivalent. Three hours. Hemenway.

253 Air Pollution. Sources of air pollution, methods of measurement, standards, transport theory and control techniques used. Emphasis on source measurement and contaminant control design. *Prerequisites:* Chemistry and Math. 21 or equivalent. Three hours. Hemenway.

254 Environmental Quantitative Analysis. Chemistry and microbiology of water quality management, diffusion equilibria, reaction kinetics, acids and bases, colloids, enzymes, bacterial physiology, pollution indicator organisms. *Prerequisites:* Permission of instructor. Four hours. Hemenway.

255 Water Renovation Processes — Chemical/Physical. Design theory of chemical/physical processes for treating waters and wastewaters; mass transfer, coagulation/precipitation, sedimentation, filtration, mixing, absorption, ion exchange, and membrane processes; and pilot plant experimentation. *Prerequisites:* 150, 151 or equivalent. Three hours.

256 Water Renovation Processes — Biological. Design theory of biological processes for treating waters and wastewaters; aerobic, anaerobic, photosynthetic processes; disinfection; and pilot plant experimentation. *Prerequisites:* 150, 151 or equivalent. Three hours.

257 Analysis of Aquatic Systems. Quantitative study of biological, chemical, and physical phenomena in lakes, streams, and estuaries; and mathematical modeling applied to management of water quality. *Prerequisites:* 150, 160 or equivalent. Three hours.

258 Environmental Facilities Design — Air. Advanced de-

sign principles for air pollution control equipment including scrubbers, precipitators, cyclones, and filters. *Prerequisites:* 252 or 253. Three hours. Hemenway.

259 Measurement of Airborne Contaminants. Quantifying airborne contaminants from processes and ambient levels. Laboratories demonstrate calibration and measurement, stack sampling, and ambient air monitoring, and specific contaminant generation and measurements. *Prerequisite:* 252 or 253 or instructor permission. Three hours. Hemenway.

260 Hydrology. The basic theory of precipitation, runoff, infiltration, and ground water; precipitation and runoff data; and application of data for use in development of water resources. *Prerequisite:* 160, Statistics 141 or equivalent. Three hours. Downer.

261 Open Channel Flow. Application of basic laws of fluid mechanics to flow in open channels; channel design, transition structures: riprap, culverts; gradually-varied flow problems including flood plain, floodway studies. *Prerequisite:* 160 or equivalent. Three hours. Downer.

264 Land Treatment of Wastes. Fundamental physical, chemical, and biological mechanisms of water and waste constituent transformation, cycling, uptake and removal in the plant/soil profile; system cost, design project centered. *Prerequisite:* Permission of instructor. Three hours.

265 Ground Water Hydrology. Principles of ground water hydraulics, well characteristics, aquifers; and use of numerical methods to solve ground water flow problems. *Prerequisites:* Math. 121 or equivalent, programming experience or permission of instructor.

271 Prestressed Concrete Structures. Ultimate strength theory, emphasis on prestress effects; prestressed beam analysis, load balancing, column and pile design, bent analysis, yieldline theory, circular prestressing in domes, tanks; current design specifications. *Prerequisite:* 173 or equivalent. Three hours. Staff.

280 Applied Soil Mechanics. Use of soil mechanics in evaluation of building foundations, braced excavations, earth structures; lateral earth pressures, pile foundations, caisson foundations, slope stability, and construction problems. *Prerequisite:* 180 or equivalent. Three hours. Olson.

282 Engineering Properties of Soils. Study of soil properties influencing engineering behavior of soils; soil mineralogy, physiochemical concepts, plasticity properties, permeability, and compaction; laboratory study of soil index properties, permeability, compaction tests. *Prerequisite:* 180 or equivalent. Three hours. Olson.

283 Designing with Geosynthetics. Geotextiles, geogrids, geonets, geomembranes, geocomposites, geopipes; design for separation, reinforcement, filtration, drainage, erosion control, liners. Applications in transportation, drainage, solid waste containment. Material testing, behavior. *Prerequisites:* 180 or instructor permission. Three hours.

290 Engineering Investigation. Independent investigation of a special topic under the guidance of a staff member. Preparation of an engineering report is required. Three hours.

295 Special Topics. Special topics in recently developed technical areas. *Prerequisite:* Senior or graduate enrollment. Three hours. Staff.

304, 305 Advanced Engineering Analysis I, II. See Mechanical Engineering 304, 305. *Prerequisites:* Math 271 or Math 230; CE 304 for CE 305. Three hours. Cross-listings: ME 304, 305; Math 275, 276.

321 Engineering Computations on Advanced Architectures. Engineering computations using multiprocessing computers, concurrent processing, algorithms for numerical approximation of differential equations, linear systems. Programming projects required. Three hours.

360 Advanced Hydrology. Application of statistics to engineering hydrology; concept, use of instantaneous unit hydrograph; study of runoff models; flow through porous media; design techniques for water resources projects. *Prerequisites:* 260, Math. 271 or instructor permission. Three hours. Offered as occasion warrants. Downer.

366 Numerical Methods for Surface Water Processes. Development of the governing equations for geophysical hydrodynamics/transport, shallow water equations, analysis and implementation of finite element/finite difference computational algorithms. *Prerequisites:* 220. Three hours.

372 Matrix Methods in Structural Dynamics. Matrices, eigenvalue problems, forced vibration, wave propagation. *Prerequisite:* 171 or instructor's permission. Three hours. Beliveau. Cross-listing: Mechanical Engineering 330.

390 Advanced Topics in Civil Engineering. Special topics to intensify the programs of graduate students in civil engineering. Hours and credits to be arranged.

391 Master's Thesis Research. Credit as arranged.

395 Advanced Special Topics. Advanced Topics in recently developed technical areas. Prerequisite: Graduate standing only. Three hours.

491 Doctoral Dissertation Research. Credit as arranged.

Classics (CLAS)

Emeritus Professors Bliss, Davison, Kidder; Professors Ambrose, Gilleland, R.H. Rodgers (Chairperson), Schlunk; Associate Professor B.S. Rodgers.

Current research interests include Early Greek Literature; the Attic orators; Greek Drama; archaeology; philosophy; Mycenaean and Homeric Greece; Cicero's rhetorical works; Vergil; lyric and elegiac poetry; Petronius; satire; Roman Imperial Families; Mythology; Etruscology; Medieval Studies.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF ARTS

An undergraduate major or minor or the equivalent; a reading knowledge of French or German.

MINIMUM DEGREE REQUIREMENTS

Eighteen hours of advanced courses in Greek and Latin, six hours of which must be 381; six additional hours in Greek and Latin, History, or Philosophy; thesis research (normally six hours). Comprehensive examinations in Greek and Latin translation, Greek and Roman history, and literature and philology are required. In addition to course work, students will have a reading list of authors in Greek and Latin.

Those who expect the department's recommendations to go on for a Ph.D. elsewhere must show competence in both German and French by the end of their first year of graduate study.

A program is also offered leading to the degree of Master of Arts in Teaching (see page 20). Satisfactory scores on the general (aptitude) Graduate Record Examination are prerequisite for acceptance to candidacy for this degree.

COURSES OFFERED

GREEK (GRK)

201 Greek Orators. Selected speeches of Lysias and Domosthenes. Three hours. B.S. Rodgers. Alternate years.

202 Greek Comedy. Two plays of Aristophanes. Three hours. Ambrose. Alternate years.

203 Greek Historians. Thucydides, Books I and II; selec-

tions from Herodotus and Xenophon's *Hellenica.* Three hours. B.S. Rodgers. Alternate years.

204 Greek Tragedy. Sophocles, *Antigone,* and Euripides, *Medea,* or two equivalent plays. Three hours. Ambrose. Alternate years.

206 Greek Epic. Reading in the *Iliad* and *Odyssey.* Problems of epic composition and language together with mythological and historical background. Three hours. Schlunk. Alternate years.

295, 296 Advanced Special Topics. Advanced special topics or seminars in Greek beyond the scope of existing formal courses. Prerequisites: Graduate or advanced undergraduate standing; permission. Credit as arranged, maximum of six hours for graduate students.

LATIN (LAT)

203 Republican Prose. Extensive reading in Caesar and Sallust, and in the speeches of Cicero. Three hours. B.S. Rodgers.

204 Epic Poets. Extensive reading in Lucretius, Vergil, Ovid, and others. Three hours. Ambrose, Schlunk.

227 Roman Lyric Poets. Selections from the works of Catullus, Horace, Propertius, Tibullus. Three hours. Alternate years.

251 Roman Letters. Letters of Cicero, Horace, and Pliny. Three hours. B.S. Rodgers. Alternate years.

252 Comedy. Two plays of Plautus and Terence. Study of the precursors of this literary form. Three hours. Ambrose. Alternate years.

253 Roman Oratory. Selections from Cicero's *De Oratore, Orator, Brutus,* and from his speeches. Historical development of forensic and other rhetorical canons. Three hours. Gilleland. Alternate years.

255 Historians of the Empire. Augustus, *Res Gestae;* Tacitus, *Annals,* I-IV; selections from Suetonius and Ammianus Marcellinus. Three hours. B.S. Rodgers. Alternate years.

256 Satire. Selections from Horace and Persius; Juvenal, Petronius. Study of the development of this literary form. Three hours. Gilleland. Alternate years.

271 Silver Latin. Extensive reading of post-Augustan authors not included in other advanced courses. Three hours. R.H. Rodgers, Gilleland. Alternate years when offered.

295, 296 Advanced Special Topics. Advanced special topics or seminars in Latin beyond the scope of existing formal courses. *Prerequisites:* Graduate or advanced undergraduate standing; permission. Credit as arranged, maximum of six hours for graduate students.

300 Proseminar. Introduction to philology. Students will normally take this their first semester. Three hours. Ambrose.

381 Seminar. Intensive study at the graduate level of Greek and Latin authors not read in the candidate's undergraduate program. Credit as arranged.

391 Master's Thesis Research. Credit as arranged. Normally total six hours.

Communication Science and Disorders (CS&D)

Professors Guitar (Chairman), Lubker (Associate Dean), Wilson; Associate Professor McCauley; Assistant Professors Kahn, C. Smith; Lecturer Houghton. Staff: Melissa Bruce, M.S., (CCC-Sp), Dinah Smith, M.A., (CCC-A), Julie Reville, M.S., (CCC-Sp), Gayle Belin-Frost, M.A., (CCC-Sp), Mary Alice Favro, M.A., (CCC-Sp).

The faculty does research in speech and language development and disorders, speech physiology and perception, and hearing disorders.

The Master of Science degree program in Communication Science and Disorders is accredited for speech-language pathology by the Educational Standards Board of the American Speech-Language-Hearing Association (ASHA). The Eleanor M. Luse Center for Communication Disorders, which shares quarters with the Department and is a primary practicum site, holds accreditation from the Professional Services Board of ASHA in both Speech Pathology and Audiology. Students are required to fulfill academic requirements for the Certificate of Clinical Competence of the American Speech-Language-Hearing Association. All students are supervised by clinically certified members of the faculty and staff of the E.M. Luse Center.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

Baccalaureate degree from an accredited institution; satisfactory performance on the general (aptitude) Graduate Record Examination. Completion of courses equivalent to CS&D 80, 90, 94, 101, a course in statistics, a course in child psychology. In order to be accepted into the program, applicants must have completed or be currently enrolled in a sufficient number of prerequisite courses so that they will have no more than one outstanding course at the time of their admission.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

Satisfactory completion of the written comprehensive examinations. Students will not be admitted to candidacy if practicum grades are incomplete. Students may write the comprehensive examination only in or following that semester in which they have completed 30 semester credits of graduate study and 300 hours of supervised clinical practicum.

MINIMUM DEGREE REQUIREMENTS

Thesis Option
The student will complete 34 hours of graduate level courses and six additional credits for conducting the research leading to an M.S. thesis. All research-oriented students will be encouraged to pursue this option. Courses taken must include six credits in audiology.

Nonthesis Option
The student will complete 40 hours of graduate level course work. These include at least 30 credits in Speech-Language Pathology, six credits in Audiology, and four credits in Clinic Study. Students are also required to give a diagnostic and/or therapeutic presentation which will be critiqued by the faculty as a whole.

COURSES OFFERED

Prerequisites for all courses: as listed, or equivalent, or by permission of instructor.

251 Disorders of Speech. In-depth survey of speech disorders: articulation, fluency, voice, etc., including those with functional as well as organic etiology will be considered. Includes one hour clinic laboratory. *Prerequisite:* 94. Four hours.

261 Disorders of Language. In-depth survey of language

disorders including aspects in reception and expressive use of language. Includes one hour clinic laboratory as in CS&D 251. *Prerequisite:* 94. Four hours.

262 Measurement and Management of Communication Disorders. Study of the construction, application, interpretation, and implementation of tests of communicative functioning. *Prerequisite:* 251 or 261. Three hours.

271 Audiological Assessment. Examination of basic parameters in measurement of hearing. Pure tone testing, masking, impedance, and speech evaluations. *Prerequisite:* 105 or permission of instructor. Three hours. Houghton.

272 Auditory Habilitation of Hearing Impaired Children. Survey of the handicapping effect of hearing disorders on the developing child and the principles of rehabilitation utilized for treatment of this disorder. *Prerequisites:* Fifteen credits in CS&D, including 94, 271. Three hours. Houghton.

281 Neuroanatomical Basis of Speech and Hearing. The neuroanatomical structures which underlie the formulation, production, and perception of speech are examined and related to language and speech behavior. *Prerequisite:* Nine credits in CS&D at the 200 level. Three hours. Kahn.

287 Current Research in Normal and Disordered Language Acquisition. Recent advances in the study of child language. *Prerequisite:* 94. Three hours.

290 Introduction to Research in Communication Science and Disorders. Study of hypothesis formation, review of research literature, and current research topics in communication science. Research project required. *Prerequisite:* At least six credits in CS&D at the 200 level. Three hours. (Not offered for graduate credit).

291, 292 Clinical Study. Supervised practicum experiences with children and adults presenting disorders of speech, hearing, and language. *Prerequisites:* 261, 262. Credit as arranged.

293, 294 Seminar. *Prerequisite:* Permission of instructor. Variable credit.

310 Preparation and Management of Speech and Language Evaluation and Therapy. Principles of behavioral observation, analysis and modification as they apply to the assessment and remediation of communication disorders. *Prerequisite:* Graduate standing. Three hours. Bruce.

373 Pediatric Audiology. Methods and techniques for hearing evaluations in children. The audiologist in the school system. *Prerequisites:* 105, graduate standing, permission of instructor. Three hours.

377 Habilitation and Rehabilitation Procedures for Hearing Impaired Adults. Electronic, social, linguistic, acoustic, psychological, and pedagogical principles of rehabilitation of the hard of hearing. *Prerequisites:* 94, 271. Three hours. Houghton.

380 Research Methods in Communication Disorders. Empirical research methodology as applied to the study of normal and deficient speech and hearing processes. Students analyze data statistically and write a research proposal. Three hours.

381, 382 Advanced Readings. Readings, with conferences, intended to contribute to the programs of graduate students in phases of communication science and disorders for which formal courses are not available. Credit as arranged, up to three hours each semester.

383 Seminar in Language/Learning Disabilities. Theories of language/learning disabilities relevant to diagnosis and treatment are reviewed. Recent research and identification/management procedures are also stressed. *Prerequisite:* 387, or permission of instructor. Three hours. Smith.

384 Articulation-Phonological Disorders. Etiology, diagnosis, pathology, and habilitation and rehabilitation of articulation of speech. *Prerequisite:* 251 or equivalent. Three hours. McCauley.

385 Voice Disorders. Study of normal and abnormal laryngeal anatomy and physiology as they relate to diagnoses and treatment of a wide variety of vocal pathologies. *Prerequisite:* 251. Three hours. Belin-Frost.

386 Neuromotor Disorders. Etiology, pathology, diagnosis, and principles of habilitation of cerebral palsy and other CNS pathologies. Emphasis on disorders of oral communication and associated disorders. *Prerequisites:* 101, 251 or equivalent. Kahn.

387 Seminar in Language Disorders. Identification, evaluation, and rehabilitation procedures for children with language disabilities. *Prerequisite:* 94. Three hours. Smith.

388 Seminar in Stuttering. Study of adult and child fluency disorders which focuses upon symptomatology, etiology, diagnosis, and rehabilitation of stuttering patients. *Prerequisite:* 94. Three hours. Guitar.

389 Seminar in Aphasia in Adults. Study of the symbolic and communicative disorders in aphasic adult patients. Rehabilitation strategies, principles, and procedures are presented. *Prerequisite:* 251. Three hours. Kahn.

391 Master's Thesis Research. Credit as arranged.

Computer Science (CS)

Professors Absher, Dawson, Golden (Chairperson); Associate Professor Hegner; Visiting Assistant Professors Batarekh, Goldweber, Share; Lecturers Douglas, Eppstein, Shaffer.

Research activities in Computer Science encompass a broad range of topics including formal language theory, operating systems, simulation, architecture, networking, artificial intelligence, and performance evaluation.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

Bachelor's degree. Satisfactory scores on the Graduate Record Examination. Mathematics 21, 22, 121, 124 or the equivalent; Statistics 151 or the equivalent; Computer Science 11, 12, 101, 102 or the equivalent.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

Mathematics 104; Electrical Engineering 131; Computer Science 103, 104, or their equivalent.

MINIMUM DEGREE REQUIREMENTS

Thesis Option
Thirty hours of which six to nine hours will be thesis research, the remainder is course work.

Nonthesis Option
Thirty-three hours of course work.

Students in both options must take or have completed the equivalent of Computer Science 201, 202 or 203, 222, 224, 243, and must take additional graduate level courses in Computer Science, or related areas with departmental permission, to fulfill the credit hour requirements.

COURSES OFFERED

Prerequisites for all courses: as listed, or equivalent, or by permission of instructor.

200 Discrete Simulation. See Civil Engineering 227. No CS graduate credit.

201 Operating System (3-0). Supervisory and control software for multiprogrammed computer systems. Processes synchronization, interprocess communication, scheduling, memory management, resource allocation, performance evaluation, object-oriented systems, case studies. *Prerequisite:* 104. Three hours.

202 Compiler Construction (3-0). Practice in design and implementation of translators for ALGOL-like languages. Regular and context-free grammars, parsing, code generation for stack and register machines. Interpreters. Run-time storage administration for block-structured languages. *Prerequisite:* 104 and 243. Three hours.

203 Programming Languages II (3-0). Formal specification and program correctness. Multitasking and parallelism. Object-oriented and applicative languages. Introduction to translator design. *Prerequisite:* 104. Three hours.

207 Operating Systems Laboratory. Programming workshops and assignments that develop or modify various components of an operating system. *Prerequisites:* previous or concurrent enrollment in 201; permission of instructor. One hour.

222 Computer Architecture (3-0). Architecture of computing systems. Control unit logic, input/output processors and devices, asynchronous processing, concurrency, parallelism, and memory hierarchies. *Prerequisites:* 102, Math. 104, EE 131. Three hours.

223 Introduction to Formal Language Theory (3-0). (Same as Math. 223). Introduction to theory and applications of context-free languages. Phrase structure and context-free grammars, normal forms, pushdown automata, decision problems, power series in noncommuting variable, applications to parsing. *Prerequisites:* Math. 104, CS 243 highly recommended. Three hours.

224 Analysis of Algorithms (3-0). Introduction to both analytical experimental techniques in algorithm analysis. Basic algorithm design strategies. Introduction to complexity theory. *Prerequisites:* 104, Math. 102 or 104, 121, 124, 173. Three hours. Cross-listing: Math. 224.

243 Introduction to Theoretical Computer Science (3-0). Introduction to the theoretical foundations of computer science. Models of computation. Church's thesis and noncomputable problems. Formal languages and automata. Syntax and semantics. *Prerequisites:* 12, Math. 104. Three hours. Cross-listing: Math. 243.

294 Independent Study. Independent readings and investigation under the direction of a faculty member. *Prerequisite:* Consent of instructor. Variable, one to three hours; may be repeated for a maximum six hours. Staff.

295 Special Topics in Computer Sciences. Lectures, reports, and directed readings on advanced topics. *Prerequisite:* Permission of instructor. Three hours.

321 Advanced Computer Architecture (3-0). Study of advances in computer architecture. Topics may include: distributed and multiprocessor systems, array and vector processors, data driven architecture, memory hierarchies, and management schemes. *Prerequisites:* 201, 222. Three hours.

323 Computer Networks (3-0). Introduction to network terminology and classification methods. Topics will include switching techniques, wide area networks, network services, standards and local area networks. *Prerequisite:* 201. Three hours.

331 Database Management Systems (3-0). Introduction to the design and implementation of modern database management systems. Data models, query languages, concurrency control, and crash recovery. *Prerequisites:* 201, 203, 243. Three hours.

341 Program Verification and Semantics (3-0). Introduction to predicate calculus. Partial and total correctness. Recursive programs and recursively defined data types. Denotational defined data types. Denotational and operational semantics. *Prerequisites:* 103, 243. Three hours.

342 Computability and Recursive Function Theory (3-0). Recursive functions. Undecidability problems. Abstract and concrete computational complexity. *Prerequisite:* 243. Three hours. Cross-listing: Math. 342.

344 Algebraic Theory of Automata (3-0). Use of algebraic methods to study automata and languages. Decomposition of machines and Krohn-Rhodes theorem. Hierarchies of rational and context free languages. *Prerequisites:* 243, Math. 251. Three hours. Cross-listing: Math. 325.

346 Theory of NP-Completeness (3-0). Classes P and NP, Cook's Theorem, techniques for proving NP-completeness, NP-hard problems, approximation algorithms and schemes, probabilistic algorithms and schemes, P vs. NP. *Prerequisites:* 224, 243. Three hours.

351 Knowledge Representation (3-0). Systematic study of the methods of representing and retrieving information in modern computers. Logical models, semantic nets, procedural nets, and rule systems. *Prerequisites:* 203, 222, 243. Three hours.

353 Automated Reasoning (3-0). Study of deduction algorithms for knowledge base systems. Propositional calculus, Quantification Theory, Gödel's Incompleteness Theorem, Turing's Theorem, Herbrand-Gödel Computability, Resolution Principle, equality and inequality relations. *Prerequisite:* 243. Three hours.

361 Advanced Operating Systems (3-0). Topics covered will generally be chosen from one or more of the following areas: detailed case studies, distributed systems, real-time systems, object-oriented systems, and security. *Prerequisites:* 201, 222. Three hours.

363 Models of Computing Systems (3-0). Studies of user and program behavior. Aspects of computer systems: scheduling, resource allocation, memory sharing, paging, deadlocks. Mathematical models, queuing systems, simulations, performance evaluation, prediction. *Prerequisites:* 201, 222, Statistics 151. Three hours.

391 Master's Thesis Research. Credit as arranged.

394 Independent Study. Independent readings and investigation under the direction of a faculty member. *Prerequisite:* Consent of instructor. Credit as arranged (three to six hours).

395 Advanced Topics in Computer Science (3-0). Subject will vary from year to year. May be repeated for credit. *Prerequisite:* Consent of instructor. Three hours.

Education

Professors Emeriti Boller, Ducharme, Gobin , Grams, Greig, Hunt; Professors Abruscato, Agne, Carlson, Conrad, Fishell, Fox, Hanley, Hasazi, Nash, Peterson, Rippa, Shiman, Williams; Associate Professors Barbour, Burrell, Clarke, Erb, Fitzgerald, Glesne, Goldhaber, Griffin, Hunter, Johnston, Lang, Larson, Letteri, Meyers, B. Nichols, Paolucci-Whitcomb, Ponzo, Rathbone, Sandoval, Shelton, Stevenson, Thompson; Assistant Professors Bright, Capone, Chase, Hood, Manning, Mosenthal, Reagin, Salembier; Research Assistant Professors Giangreco, Hamilton, Lund; Research Associate Professors Cloninger, Thousand; Visiting Assistant Professor Keogh; Lecturers Bakeman, Burdett, Christie, Collins, Conte-Scheer, Cravedi-Cheng, Dennis, Edelman, T. Fox, Godek, Horel, Kay, McNeil, Mellencamp, Mueller, Pierce, Razza, Ross-Allen, Schattman, Shepherd, Sugarman, Taft, Watson, Yuan; Extension Associate Professor E. Nichols.

The College of Education and Social Services offers numer-

ous opportunities for graduate study in preparation for special competencies in a variety of fields which include practica, research problems, and in-service relationships with cooperating school systems and social service agencies. The programs in various areas of specialization are described below.

Satisfactory performance on the aptitude sections (verbal and quantitative) of the Graduate Record Examination is required for admission to the Graduate College for students pursuing the degrees of Master of Education, Master of Science, and Doctor of Education.

DOCTOR OF EDUCATION IN EDUCATIONAL ADMINISTRATION

A Doctor of Education (Ed.D.) degree is offered in Educational Administration. This is an applied research based program for professionals serving in educational management positions in schools and school-related organizations; e.g. state departments of education, professional associations, higher education, and human service agencies.

Program emphases include: the design and implementation of educational research; adaptation of theoretical constructs and models to educational and social service settings; knowledge and skills in interorganizational relationships; theory and research; budget planning and policy studies, and program and personnel evaluation.

This program has been designed to respond to the expanding demands placed on educational administrators in educational and human service organizations where they are increasingly expected to design and supervise local research and varied evaluative studies; interpret and apply recent national research findings; analyze and apply governmental regulations and court decisions; develop organizational responses to emerging social expectations; organize and lead staff development programs; understand and apply broad-based economic principles and social and fiscal policy; develop and manage budgets; assess and respond to the psychological needs of educational consumers; employ effective interpersonal management and decision-making skills.

PREREQUISITES FOR ADMISSION TO GRADUATE STUDIES

Applicants must possess a master's degree from an accredited institution and a cumulative grade-point average of 3.00 for previous graduate study. Other requirements include satisfactory scores on the General Test of the Graduate Record Examination (GRE) and a representative writing sample.

Students admitted to graduate studies must complete successfully five core courses. Upon such completion and submission of a qualifying paper, students will be considered for candidacy for the degree.

PREREQUISITES FOR ACCEPTANCE TO CANDIDACY FOR THE DEGREE OF DOCTOR OF EDUCATION

Satisfactory completion of all core requirements and the qualifying paper will satisfy the prerequisites for acceptance to candidacy.

Requirements for the degree of Doctor of Education include a minimum of 56 semester credit hours of doctoral studies completed at UVM following formal admission to the program with the following distribution.

15 semester hours in the five core courses
21 semester hours general distribution (minimum)
Dissertation Research — 20 semester hours (minimum).

All course credit hours beyond the core are distributed in administration and planning, humanities, research and statistics courses, and clinical studies. Cognate courses in other UVM departments may be included in individual programs.

RESIDENCY REQUIREMENT

The residency requirement for the Doctor of Education (Ed.D.) degree consists of the following:

1. Completion of the five core courses (15 semester hours), *and*
2. Completion of 12 semester credit hours of work during two contiguous semesters beyond the core.

For further requirements concerning Studies Committees, Research and Dissertation, and the Dissertation Defense Examination Committee, refer to "General Requirements for the Degree of Doctor of Philosophy," page 20.

Application deadline, including receipt of GRE scores, is April 1, effective 1993.

Detailed information on the course of study is available from Program Director, Herman Meyers, Associate Professor, Department of Organizational, Counseling, and Foundational Studies.

MASTER OF EDUCATION

For admission to a Master of Education program, the applicant must present satisfactory scores for the Graduate Record Examination (general portion) at the time of application for admission. Before the degree is awarded, the candidate must have completed one year of successful teaching experience or other educational service. This requirement may be fulfilled by satisfactory completion of student teaching, an internship, or a practicum.

The graduate program of each student admitted to candidacy for the degree of Master of Education is planned and supervised by an advisor in the respective program area. Program planning is based upon the student's undergraduate curriculum, professional experience, and aims and purposes in pursuing the master's degree.

Each program must include a minimum of either 30 semester hours of approved course work or 24 hours earned in courses and six hours in thesis research. Contingent on a candidate's background and interests and on program specification, additional credit hours may be required. If a student's preparation is inadequate to begin study at the graduate level, additional undergraduate courses will be required. Each Master of Education degree program must include a minimum of six semester hours of graduate work in the foundations of education unless this requirement or its equivalent has been met previously. Graduate courses which currently fulfill this requirement include: EDFS 204, 205, 206, 209, 255, 302, 303, 314, 347, 352, 354, and EDSS 313 and EDLS 377.

To insure effective planning of a graduate program for the degree of Master of Education, no more than nine hours credit will be accepted in partial fulfillment of degree requirements for courses taken prior to acceptance to the Graduate College.

Comprehensive Examination

A comprehensive examination is required. However, it may be written, oral, or both. The choice of the examination format will be made by faculty members in the area of specialization after consultation with the advisor and the candidate.

a. The written comprehensive examination will cover the field of education with emphasis on the area of specialization.
b. The oral comprehensive examination will emphasize the area of specialization.

All examinations are taken on the University campus in Burlington. Only one re-examination is permitted for any final comprehensive examination. It is the responsibility of the candidate to schedule the required examination with the College of Education and Social Services. Since each program has different options for meeting the oral and written comprehensive requirements, candidates must contact the respective program chairperson or advisor regarding program policy.

Thesis Option
If the thesis option is elected, there must be an oral or written comprehensive examination *prior to* the oral examination in defense of the thesis.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF EDUCATION

Eighteen hours of Education and related areas or appropriate professional certification. The Education courses prerequisites may not apply to the Higher Education and Student Affairs Administration, Administration and Planning, or Interdisciplinary Major Program in OCFS. This is particularly true of persons seeking positions which do not require public school certification.

MINIMUM DEGREE REQUIREMENTS

Eighteen hours in courses in Education numbered above 200, including a minimum of six graduate hours in the foundations of education, 12 additional hours in approved courses or six additional hours and thesis research; a year of successful experience in teaching or in a related educational activity.

CERTIFICATE PROGRAMS

The following certificate programs are offered for post-baccalaureate study by the College of Education and Social Services. They do not lead to a graduate degree and are not offered by the Graduate College. Interested persons are encouraged to contact directly the Dean's Office of the College of Education and Social Services for further information.

POST-BACCALAUREATE TEACHER PREPARATION PROGRAM

The Post-Baccalaureate Teacher Preparation Program is designed for individuals who have a bachelor's degree from an accredited four-year institution and who want to become licensed to teach in Vermont. The basic program fulfills the professional education requirements for state licensure. Areas and levels of licensure include: Grades K-12 — art, health education, music, physical education; Grades K–6 (elementary) — general elementary education, physical education; Grades 7–12 (secondary) — English, foreign language, mathematics, physical education, science, social studies.

Applicants to the Post-Baccalaureate Teacher Preparation Program must meet the following entrance criteria.

1. Hold a bachelor's degree from an accredited institution of higher education.
2. Possess a general education background based on those studies known as liberal arts which embrace the broad areas of a social and behavioral sciences, mathematics, biological and physical sciences, the humanities, and the arts.
3. Demonstrate a commitment to the teaching profession.
4. Have obtained an overall GPA of 2.5 in undergraduate course work.
5. For secondary candidates: Previous course work must include 30 semester hours in one of the academic areas listed below to meet Vermont state licensure requirements for the major academic concentration.

   Majors: Biological science, chemistry, earth science, English, French, geography, German, history, Latin, mathematics, physical science, physics, Spanish.

   Broad Field Majors: Natural science, social studies, environmental studies.
6. For secondary candidates: Have obtained a GPA of 2.5 in the academic area in which licensure is desired.

The Post-Baccalaureate curriculum includes both undergraduate and graduate courses. Nine graduate credits may apply toward the M.Ed. degree at UVM, contingent on acceptance into the Graduate College.

The deadline for applications is April 15 for the next academic year. Course work begins during the summer or fall, depending upon the area of licensure. Applications are accepted and considered only once each year with updated informational materials and application forms available in January. Requests for further information about the PBTP Program and application forms may be obtained by contacting the PBTP Coordinator, Department of Professional Education and Curriculum Development, 533 Waterman Building.

CERTIFICATE OF ADVANCED STUDY

A Certificate of Advanced Study (sixth-year certificate), a 30- to 36-graduate credit hour program beyond the master's degree, is offered in the following fields:

a. Administration and Planning. A program designed to prepare administrators and planners for public schools, educational and social agencies, and middle management positions in higher education.

b. Counseling. Individuals who have completed a master's degree for admission to the C.A.S. program. The program is designed to further develop skills in counseling, consultation, and program planning and coordination.

c. Integrated Studies. A program designed for students who have completed their master's degree and are interested in exploring a self-designed, integrated program of study drawing upon graduate level experiences currently provided by departments of Organizational, Counseling, and Foundational Studies; Special Education; Professional Education and Curriculum Development; Human Development Studies of the College of Education and Social Services and other University departments. The program does not lead to any type of state licensure.

   Inquiries about these three programs can be addressed to the Coordinator of the respective program in 228 Waterman Building.

Special Education offers the Certificate of Advanced Study to students with appropriate master's degrees in the following areas: consulting teacher/learning specialist, early intervention, essential early education, integration specialist, and intensive special education. A minimum of 30 credit hours of course work is required.

DEPARTMENTS

I. Professional Education and Curriculum Development

In the event of restrictions on enrollment, preference will be given to Vermont residents holding professional positions in education and social services.

Curriculum and Instruction. This master's program is designed to develop leadership in such educational settings as teaching, curriculum theory, curriculum development, and related areas of research for elementary and secondary public and private school settings. Areas of focus within the M.Ed. in addition to those described in detail below include elementary or secondary education, information technology, and health/physical education. The program is also appropriate for those with teaching roles in human services agencies.

Programs are developed to provide a comprehensive background in fields basic to instruction and curriculum development as well as the application of that knowledge to a specialized field. They include courses aimed at the examination and improvement of instructional practices in elementary and secondary schools, and understanding of curriculum theory and the application of curriculum development. Opportunities for independent study and research are encouraged in the specializations represented in the course offerings of the Department of Professional Education and Curriculum Development.

As in the education of teachers enrolled for pre-service degrees work at the graduate level also draws upon other divisions of the University, thus enabling the College to develop strong programs of professional education which include academic offerings in the various teaching fields in elementary and secondary education. Degree concentrations, in addition to those listed below, can be developed on an interdisciplinary basis responding to student strengths and needs.

Courses in teacher education include: 211, 217, 218, 225, 227, 228, 241, 244, 245, 248, 256, 257, 259, 261, 270, 271, 321, 333, and 343.

Inquiries regarding these programs should be addressed to Darlene Nelligan.

Within the Curriculum and Instruction Program Area, it is possible to concentrate in school library media. This satisfies the need for the practicing teacher to develop abilities in the use of computer-assisted instruction, programmed learning, tape cassettes, film, and video tape. The individual will pursue a specialization that allows the acquisition of a perspective that broadens that potential use of a school media library. Depending upon the course work selected, the graduate could become certified as an elementary or secondary school librarian. A minimum of 18 hours of study in library and media courses is necessary for a concentration in school library-media education. Minimally, the graduate is conversant with the tools available to the classroom teacher in a school library-media center and the graduate has practical application of those skills.

Inquiries regarding this program should be addressed to Professor Helene Lang. THIS PROGRAM DESIGNED TO BE OFFERED DURING THE SUMMER ONLY.

Reading and Language Arts. The purpose of this program area is to prepare teachers and specialists in the field of reading. Classroom teachers, reading specialists or consultants, supervisors, administrators are responsible for developing programs which will enable every student to attain their maximum proficiency in the use of reading and language. To meet this end, several courses have been devised which focus on classroom reading instruction and reading difficulties. Through the Reading Center, students also have opportunities for laboratory experiences as well as for research and study in reading, literature, and language arts.

Courses in reading and language arts include: 222, 223, 234, 375, 376, 378, and 379.

Inquiries regarding this program should be addressed to Professor Marjorie Lipson.

II. Special Education

The M.Ed. degree is offered in three areas of emphasis: Consulting Teacher/Learning Specialist, Essential Early Education, and Intensive Special Education. Each area requires that students have appropriate professional experience and be licensed in preschool, elementary, secondary or special education. License requirements may be waived given appropriate preschool experience for the Essential Early Education Area only. All three areas are approved by the State of Vermont, and successful completion leads to a licensure endorsement for special education in Vermont. Each area requires EDSP 301 and 384 and the appropriate sections of 310, 311, and 312, as well as full year internship. Additional courses are required specific to each area for a usual total of 36 credit hours.

Consulting Teacher/Learning Specialist. Students are prepared to collaborate with families, educators and other professionals in the design, implementation and evaluation of instruction for learners with mild to moderate handicaps in integrated regular elementary or secondary classrooms.

Essential Early Education. Students are prepared to provide individualized, family-centered special education services to young children with handicaps and their families through both direct and collaborative delivery systems coordinated with social service agencies in integrated home, preschool and community settings in rural areas.

Intensive Special Education. Students are prepared to provide direct and collaborative instruction to learners with severe handicaps on the basis of identified activities, skills, adaptations and transitions needed for learners to function in current and future integrated school, home and other community environments, with services involving learners' parents and a variety of professional disciplines.

In addition, a Certificate of Advanced Study (sixth-year certificate) (see page 53) with a usual total of 36 credit hour program may be arranged for applicants who have already earned a Master's degree.

Additional information on the above should be requested from the Chairperson.

III. Organizational, Counseling, and Foundational Studies

This Department consists of Administration and Planning, Counseling, Higher Education and Student Affairs Administration, and Educational Studies. There are degree programs in educational administration, school and community counseling, higher education, educational studies, and interdisciplinary studies.

Administration and Planning. This program is designed to prepare leaders for public schools, educational and social agencies, and middle management positions in higher education. The M.Ed. program for licensure usually requires 39 to 42 credit hours of courses including seminars, or area internships, and research experiences. The Certificate of Advanced Study (C.A.S.) Program usually requires 30 to 36 credit hours of study beyond the M.Ed. requirements.

Courses with an administration/planning focus include: 264, 266, 268, 280, 332, 333, 334, 335, 336, 337, 353, 354, 355, 356, and 358.

Inquiries regarding this program should be addressed to Professor H. W. Meyers.

Higher Education and Student Affairs Administration. The graduate program in Higher Education and Student Affairs Administration is designed to prepare professionals to apply human development, organizational, and counseling principles to their work with students in higher education. Graduates of the master's degree program possess substantial knowledge in human development, research and evalu-

ation, campus ecology, administration and planning, organizational development, higher education policy, and counseling. Graduates assist colleges and universities in attaining the goals of higher education by serving as policy makers, student service providers, educators, counselors, researchers, activities programmers, consultants, evaluators, and administrators.

The curriculum, including learning modules, practica internships, and graduate assistantships, combine to integrate conceptual knowledge with administrative practice. This curriculum enables all students in the program to gain an understanding of the student affairs profession, concepts of college student development, history of American higher education, counseling and intervention strategies, professional ethics, research competencies, and the administration of American colleges and universities. An array of 60 practicum internships in student affairs offices and academic departments helps students to integrate their conceptual knowledge with student affairs practice.

Students in the higher education and student affairs graduate program typically hold a 20 hour per week graduate assistantship in student affairs offices, residential life, or academic support units. Stipends cover tuition and fees for 20 credit hours of study each year and a bimonthly salary. Hall Advisor positions in Residential Life have room and board deducted from their stipend payments.

Courses required for the M.Ed. degree in Higher Education and Student Affairs include: 297, 360, 362, 380, 385, 387, and 397. Forty credit hours are required for the M.Ed. degree.

There is also a Higher Education concentration in the Education Administration doctoral degree (Ed.D.) which requires the same core courses (see Ed.D.) and a program of studies focusing on the administration of student affairs programs in higher education.

Inquiries regarding these programs should be addressed to Professor Deborah Hunter.

Educational Studies. The Foundations of Education faculty offer graduate courses in foundations of education and a master's degree in Educational Studies. The degree program is a research and scholarship based program for students from a diversity of educational fields including instruction, administration, policymaking and analysis, social services, state departments of education, allied educational professions (counselors, health care personnel, journalists), school boards, and international education. Students study past, present, and future educational problems and practices from the perspectives of the several disciplines; and they make cross disciplinary connections to discover the themes common to all the disciplines as well as to the theory and practice of education. These students study the process of making professional judgments about educational practice that include ethical, political, historical, literary, cultural, and social considerations. They strive to understand more profoundly not only the "what" and the "how" of the education professions, but the "why" as well.

Students in this program learn how to become competent scholars and researchers in the field of education by knowing the pertinent literature, staying abreast of the latest policy developments in the field, and communicating this information effectively to various audiences through competent, discipline-based research, publication, and teaching. Students also strive to acquire the values, understandings, and skills necessary to advance a conception of the good society which includes respect for human dignity, a belief in human rights, and an ethic of service to others.

The master's degree in Educational Studies is tailored to the intellectual and professional interests of the student. Students plan their course of study with a faculty advisor in the program. Students are urged to elect courses and organize their research around problems of interest to them.

Courses applicable to the Educational Studies Program include: 204, 205, 206, 209, 255, 302, 303, 314, 347, 352, and 354.

Inquiries regarding this program should be addressed to Professor David R. Conrad.

Interdisciplinary Major. This degree program is for students who wish to pursue an individually designed, integrated program of study. The program draws primarily from graduate courses in Administration and Planning, Counseling, Higher Education and Student Affairs Administration, and Educational Studies but may include courses from other departments within the College and the University. A minimum of 36 credit hours is required for completion of the program. The program is ideally suited for persons whose personal and professional development requires a combination of course work not readily available in other graduate programs, or for individuals who plan to assume new or emerging roles in the fields of education or social and human services.

Applicants should have a clear understanding of how the Interdisciplinary Program will serve their career goals. For this reason, major emphasis in admissions is placed upon the applicant's Statement of Purpose. Applicants are strongly encouraged to contact the Department of Organizational, Counseling, and Foundational Studies, 228 Waterman Building, prior to making application for admission. Detailed information about the program and admissions criteria will be supplied upon request.

Inquiries regarding this program should be addressed to Professor Robert Nash.

Counseling Program (Master of Science). This degree program prepares individuals to develop professional knowledge and skill in counseling and psychotherapy for use in school guidance, college settings, and community social service agencies. The school counseling course of study is state-approved to meet the requirements of the State of Vermont for licensing as a school counselor, K–12. The community counseling program meets degree requirements for application to become a certified Clinical Mental Health Counselor as defined by Vermont legislation. Graduates are encouraged to seek ongoing supervision, consultation, and continuing professional education throughout their careers.

To achieve professional competence, students are expected to become knowledgeable and skilled in the following areas: dynamics of human growth and development; social and cultural foundations; theory and practice of helping relationships; group dynamics and leadership; lifestyle and career development; appraisal techniques; research and evaluation; professional orientation; administrative and planning concepts; personal growth and development (including self-awareness, interpersonal relations, and physical and mental health). Supervised internship in an appropriate field setting is of major importance in the program.

The specific composition of students' programs, designed with the assistance of a faculty advisor, is based on University, College, and Program requirements as well as the individual student's background, current needs and desires, and future goals. Learning experiences consist of a balance between theory and supervised practice.

Forty-eight semester hours of course work are required for completion of the Counseling Program. Students are expected to have at least 18 credit hours in education, psychology, social work, sociology, anthropology or related areas prior to admission, including at least one course in lifespan human development. Students in the school counsel-

ing program may be required to take prerequisite coursework in education if their background in understanding of the school environment is weak. Successful completion of the program is based on the demonstration of appropriate knowledge, relevant skills, and personal characteristics, as well as the accumulation of credits.

The Council for Accreditation of Counseling and Related Educational Programs (CACREP), a specialized accrediting body recognized by the Council on Postsecondary Accreditation (COPA) has conferred accreditation to both the program in Community Counseling (M.S.) and the program in School Counseling (M.S.)

In addition to the general admissions procedures, a personal or group interview is required of each applicant. For a more detailed description of the program, contact Professor James Peterson, Dept. of Organizational, Counseling, and Foundational Studies, 411 Waterman Building.

COURSES OFFERED

The College of Education and Social Services offers the following courses on a program basis. Departmental permission is required for enrollment.

200 Contemporary Issues. Designed so that its content and structure may accommodate special issues not especially appropriate within the boundaries of an existing course. *Prerequisites:* Twelve hours in education and related areas. One to six hours. (ECHD, EDAP, EDCO, EDEL, EDFS, EDHE, EDHI, EDLI, EDLS, EDPE, EDSC, EDSP, EDSS)

295 Laboratory Experience in Education. Supervised field work designed to give students experience in specialized areas for their professional development. *Prerequisite:* Permission of the Coordinator of Professional Laboratory Experiences. One to six hours. (ECHD, EDAP, EDCO, EDEL, EDFS, EDHE, EDHI, EDLI, EDLS, EDMU, EDPE, EDSC, EDSP, EDSS)

319 Internship for Specialized Personnel in Education. Students will undertake an approved internship in an institution which reflects the particular area of interest and needs of the student. *Prerequisite:* Permission of instructor. Credit as arranged. (ECHD, EDAP, EDCO, EDEL, EDHE, EDHI, EDLI, EDLS, EDPE, EDSC, EDSP, EDSS)

380 Professional Problems in Education. Designed to cover selected educational problems in depth. The major emphasis will be on intensive and critical analysis of the literature and practice in a given area. Three hours. (ECHD, EDAP, EDCO, EDEL, EDFS, EDHE, EDHI, EDLI, EDLS, EDPE, EDSC, EDSP, EDSS)

382 Teaching Internship. Supervised teaching experiences on a full-time basis, with related seminars in teaching subject. *Prerequisite:* Permission of coordinator of Professional Laboratory Experiences. Three to eight hours. (ECHD, EDEL, EDHE, EDPE, EDSC, EDSP, EDSS)

391 Master's Thesis Research. Thesis topic must be approved by a faculty committee. Credit as arranged. (ECHD, EDAP, EDCO, EDEL, EDFS, EDHE, EDHI, EDLI, EDLS, EDPE, EDSC, EDSP, EDSS)

397 Problems in Education. Individual work on a research problem selected by the student in consultation with a staff member. *Prerequisite:* Twelve hours in education and related areas; endorsement by a sponsoring faculty member. One to six hours. (ECHD, EDAP, EDCO, EDEL, EDFS, EDHE, EDHI, EDLI, EDLS, EDPE, EDSC, EDSP, EDSS)

ECHD—EARLY CHILDHOOD AND HUMAN DEVELOPMENT

(See page 102.)

EDAP—ADMINISTRATION AND PLANNING

264 Evaluation in Education and Social Services. For educational and social service personnel. Overview of the state-of-the-art of evaluation, emerging concepts, related models. Potential applications to settings; systematic data analysis. *Prerequisite:* Twelve hours in education or permission of instructor. Three hours.

266 Educational Finance. National, state, and local practices in educational financing and taxation; educational policies and incentives in funding; other revenue sources; financial expenditure procedures. *Prerequisite:* Twelve hours in education or permission of instructor. Two to three hours.

268 Educational Law. Legal basis for education. State and Federal statutes; related court cases; Attorney General opinions; Special Education procedures; Vermont State Board and State Education Department policies; regulations. *Prerequisite:* Twelve hours in education or permission of instructor. Two to three hours.

280 School Business Management. Analysis of basic management concepts applied to administering schools. Topics include leadership/management trends, types of budgets, risk management, planning, and other personnel and business operations issues. *Prerequisite:* Twelve hours in education. Three hours.

291 Special Topics in Organizational and Human Resource Development. Special issues in counseling, administration and planning, social work, or higher education not appropriate to content of existing courses. Courses will reflect the social services orientation of OCFS. Variable hours.

332 Seminar in Administration and Planning. Opportunity for students to experience, apply selected administration and planning concepts, skills through seminar and selected simulations of public school and social service organizational settings. Three hours.

334 Effecting and Managing Change in Educational and Social-Service Organizations. Change processes and models, the dynamics of change within the organization, and external factors affecting change. Managerial, leadership, and organizational factors and conditions impacting on innovations; change phases of initiation, implementation, and institutionization. *Prerequisite:* Twelve hours of graduate study. Three hours.

335 Staff Evaluation and Development. Supervisory roles, behavior, responsibilities, and relationships in educational and social service organizations; processes for evaluating the performance, promoting the development of staff, and increasing organization effectiveness. Three hours.

336 Curriculum Management in Educational and Social Service Organizations. Approaches to coordinating and managing curriculum or programs at the classroom, department, or organizational level; examination of factors effecting design and delivery of curriculum; developing curriculum guides and assessment methods. *Prerequisites:* 18 hours of education and related areas or appropriate professional certification. Three hours.

337 Political Processes in Education and Social Service Organizations. Political and operational relationships between schools, agencies, and other organizations at all governmental levels. Policy development, working with policy boards, and coordinating organizational and community activities. Three hours.

352 Analysis of Educational and Social Service Organizations. Organizations as open or closed systems; examinations of goals, power, conflict, leadership, decision making roles, communication; diagnosing causes of organizational problems; factors aiding, impeding organizational change. Three hours.

353 Seminar in Organizational Leadership. Roles, functions, relationships and responsibilities in maintaining and changing organizations; leadership styles and behavior; trends and issues impacting on organizations. Three hours.

354 General and Social Systems Theory. General Systems Theory is analyzed in terms of its utility for examining social systems, macrosystems analysis of research, planning, and interdisciplinary dialogue. Three hours.

355 System Analysis and Planning. An analysis of and experience with planning theories and techniques that derive from General Systems Theory. Three hours.

356, 357 Seminar in Futurism and Planning. Knowledge, values, attitudes relating to concepts about the future; alternative futures, trend analysis, goal setting; planning processes applied to educational and social service organizations. Six hours (each semester can be taken independently).

358 Seminar in Community Education. The seminar participants will analyze the Community Education process, relate the process to community development, and develop strategies for the planning and implementation of Communication Education. Three hours.

367 Human Behavior in Education Systems. This course will enable students in the Doctorate in Education program to understand and assess human behavior as it affects and is affected by education systems. *Prerequisite:* Ed.D. students have priority. Three hours.

372 Leadership and the Creative Imagination. Leadership in societal organizations as presented in literature, other media. Students will demonstrate abilities to integrate leadership theory, principles, personal beliefs, practices with literary and other media models. *Prerequisite:* Ed.D. students have priority. Three hours.

386 Organization and Human Resource Development. The concept and practice of organization development, analysis of and laboratory experience in the utilization of intervention methodologies. *Prerequisite:* One course relating to human relations and one course relating to organizations or equivalent, or permission of instructor. Three hours.

409 Applied Educational Research. Links educational research methodology with principles of systems change in order to provide a knowledge base for conducting applied educational research. *Prerequisite:* Doctoral level standing. Three hours.

432 Seminar in Small Systems Administration and Planning. Designed to familiarize participants with knowledge and research relevant to developing an applied theory of action for administering small rural educational systems. *Prerequisite:* Doctoral level standing. Three hours.

437 Seminar on Education Policy. An examination of the nature and function of education policy, emphasizing the structure and processes in education policy formulation and implementation. *Prerequisite:* Doctoral level standing. Three hours.

491 Doctoral Dissertation Research. Credit as arranged.

EDCO—COUNSELING

220 Developmental Perspectives in Counseling. Approaches to understanding human behavior in applied settings emphasizing behavior development as an interpersonal process. *Prerequisite:* Twelve hours in education and psychology. Three hours.

291 Special Topics in Counseling. Special issues in counseling, administration and planning, social work or higher education not appropriate to content of existing courses. Courses reflect the social services orientation of OCFS. Variable credit.

310 Counseling Strategies for Teachers. Counseling strategies appropriate for use in the classroom for class management assessment and utilization of different learning styles, and promotion of positive behavior change. *Prerequisite:* Permission. Three hours. Peterson.

321 Theory and Practice in Consultation. The consultation relationship in educational and social service settings. *Prerequisites:* EDCO 220, permission of instructor. Three hours.

350 Professional Issues in Counseling. Critical analysis of the various facets of counseling within the current cultural setting. Special emphasis upon goals of the helping process and their justification. *Prerequisite:* Twelve hours in education and psychology. Three hours.

351 Using Tests in Counseling. Techniques used to explore the psychology of individual differences and group assessment. Experience given in taking, administering, interpreting various tests; study project for application to any setting. *Prerequisite:* Twelve hours in education. Three hours.

360 Diagnosis and Treatment Planning in Counseling. Psychosocial, sociocultural, and historical definitions of deviant behaviors; assessment and diagnosis of mental illness according to DSM-III-R categories; treatment modalities; referral processes and prevention strategies. Taught from counseling perspective. *Prerequisites:* Graduate standing, permission of instructor. Preference given to mental health counselors. Three hours. Reagin.

368 Life Style/Life Script Assessment. Technique for developing, understanding an individual's subjective method of perceiving life events. Applications of the technique in various counseling modalities. Practice in use of technique. *Prerequisites:* EDCO 220, 374, permission of instructor. Three hours.

370 Counseling in the Elementary School. Development of elementary school counseling programs. Techniques appropriate to such settings: classroom discussions, parent education, teacher consultation, appraisal techniques, etc. Enhancing development of positive self-concept. *Prerequisites:* EDCO 220, 350. Three hours.

371 Counseling in the Secondary School. Study of secondary school guidance with focus on a comprehensive developmental model. Topics include foundations, counselor role, curriculum, delivery systems, development and organization of programs, and counseling the adolescent. *Prerequisites:* 374 or equivalent. Three hours. Peterson.

374 Counseling Theory and Practice. Theoretical and practical approach to understanding of the counseling process. Refinement of personal philosophy, theory of counseling, and implementation in practice. *Prerequisites:* Twelve hours in education and/or psychology, permission of instructor.

375 Laboratory Experience in Counseling. Supervised practice in counseling techniques. Students develop skills and receive feedback. Use is made of videotape facilities. *Prerequisites:* Counseling majors only, concurrently enrolled in EDCO 374 or consent of instructor. Three hours.

380 Professional Problems in Counseling. Covers selected counseling and counseling-related problems in depth. Major emphasis on interpersonal and critical analysis of the literature and practice in a given area. Three hours.

381 Counseling for Lifestyle and Career Development. Counseling applied to helping people plan and live satisfying vocational careers within the context of optimal lifestyles: issues of gender, age, race, ethnicity, SES considered. *Prerequisite:* 374 and 375 or their equivalent. Three hours.

383 Counseling Practicum. Introductory supervised expe-

rience in counseling in a field setting. Includes 100 hours working as a counselor with a minimum of 40 hours of direct service experience. *Prerequisites:* 350, 374, 375 and permission. Open only to master's candidates in counseling program. One hour. Peterson, Ponzo, Reagin, Schepp.

384 Internship in Counseling. Supervised experiences in counseling settings. Minimum of 60 hours in actual counseling relationships. Analysis, evaluation of verbatim samplings. For students nearing completion of degree. *Prerequisites:* 350, 374, 375, permission of instructor. Variable hours, one to six. Peterson, Ponzo, Reagin, Schepp.

386 Organizational Development for Counseling and Related Services. The concept and practice of organization development, analysis of and laboratory experience in the utilization of intervention methodologies. *Prerequisite:* Permission of instructor. Three hours.

388 Family Counseling: Systems. Theory and process of counseling with families, including family theory and current family theory orientations and intervention skills. Includes practice of counseling interventions. *Prerequisites:* EDCO 220, 374, permission of instructor. Three hours. Peterson.

389 Family Counseling: Interventions. Supervised practice in family counseling. *Prerequisites:* EDCO 388, permission of instructor. Peterson.

390 Advanced Counseling Seminar. Analysis and practice of advanced counseling skills with focus on new developments. Emphasis on integration of theory and technique into a consistent counseling model. *Prerequisites:* EDCO 374, 375, 384, consent of instructor. Three hours. Peterson.

392 Group Dynamics: Theory and Experience. Encounter group experiences for prospective counselors providing increased awareness of self and of models of relating to others. Theory, practice of group dynamics. *Prerequisites:* Twelve hours in education and psychology, permission of instructor. Three credits.

393 Advanced Study in the Theory and Practice of Group Counseling. Advanced study of group counseling theory as applied to group establishment and intervention strategies. A field experience in group counseling is required. Three hours.

394 Special Topics in Counseling. Special issues in counseling, administration and planning, social work, higher education not appropriate to content of existing courses. Courses will reflect the social services orientation of OCFS. Variable credit.

395 Sexuality Counseling and Therapy. Facilitates the transfer of general counseling and therapy skills to work with sexual issues. Study and practice cover both remediation and prevention. *Prerequisite:* Eighteen hours graduate course work in counseling or psychology, or permission of instructor. Three hours. Schepp.

397 Independent Study in Counseling. Individual work in counseling or counseling related area selected by student in consultation with faculty. Must follow University and program criterla. *Prerequisites:* Twelve hours in education and related areas; endorsement by a sponsoring faculty member. One to six hours.

399 Program Completion Seminar. Students are aided in preparation of a scholarly paper to be presented and discussed in seminar and submitted for publication review. *Prerequisite:* Major in counseling program in final or next to final semester. One hour. Ponzo.

EDEL—ELEMENTARY EDUCATION

222 Improvement of Reading Instruction in the Elementary School. Analysis of philosophies, program, and instructional practices for teaching reading. Examination and evaluation of basal textbook, individualized, and specialized reading programs. *Prerequisites:* Twelve hours in education and/or related areas including an introductory course in reading or permission of instructor. Three hours.

234 Literature and Language for Children and Youth. Characteristics, interests, reading habits of children and youth; selection, evaluation of literature. Organizing book units for teaching literature, for content areas. Emphasis on development of oral, written expression. *Prerequisite:* Twelve hours in education and related areas or consent of instructor. Three hours.

241 Science for the Elementary School. Examination of elementary school science programs. Emphasis on methods and materials relating to construction, use of science units for children in grades K–6. *Prerequisites:* Twelve hours in education and related areas, or permission of instructor. Three hours.

244 Social Studies in the Elementary School. Study of literature, research, and problems in teaching social studies in the elementary school. *Prerequisite:* Twelve hours in education and related areas. Three hours.

256 Methods and Materials in Elementary School Mathematics. Evolution of mathematical concepts, notations. Meaning of numbers, number-systems. Theory underlying fundamental operations, metric measurements, analysis of modern approach to mathematics. Manipulative approach to teaching mathematics. *Prerequisite:* Twelve hours in education and related areas. Three hours.

270 Kindergarten Methods and Organization. Objectives, organization, curriculum, methods and materials, and relationships of kindergarten preschool experiences. *Prerequisite:* Twelve hours in education and related areas. Three hours.

271 Kindergarten Education with Laboratory Experiences. Designed to acquaint the prospective kindergarten teacher with educational research conducted by Piaget, Bruner, Montessori, and others with experiences provided for working with children of kindergarten age. *Prerequisite:* Twelve hours in education and related areas. Three hours.

375 Analysis of Reading and Related Difficulties. Analysis and evaluation of learning difficulties with emphasis on reading and writing; nature of difficulties; procedures and materials for assessing reading performance. Involvement with children is required. *Prerequisite:* Six hours in reading and three hours in education or permission of instructor. Three hours.

376 Laboratory Experiences in Reading and Related Language Instruction. Approaches for prevention, correction of reading and written language difficulties. Supervised teaching of individuals and/or small groups experiencing reading and language problems. Apprenticeships in reading instructional programs. *Prerequisite:* 375. Three hours.

378 Advanced Study and Research in Reading and Related Language Arts. Survey of research, comparison and evaluation of emerging programs design and development of projects in reading. *Prerequisite:* Fifteen hours in education including nine hours in the field of reading and language education or permission of instructor. Three hours.

379 Seminar in Reading Instruction. Study of reading relative to total curriculum. Significant trends, concepts related to specific problems, programs in reading and language arts instruction; role of supervisor and reading consultant. *Prerequisite:* Fifteen hours of education including nine hours in the field of reading and language education or permission of instructor. Three hours.

EDFS—FOUNDATIONS

204 Seminar in Educational History. Selected topics in

history of education. Education in democratic and authoritarian social orders. Topics: education of women, black heritage, American higher education in transition. *Prerequisite:* Twelve hours in education and related areas or permission of instructor. Three hours.

205 History of American Education. Educational principals and practices in the U.S. as they relate to the main currents of social history. Key ideas of historic and contemporary significance. *Prerequisite:* Twelve hours in education and related areas or permission of instructor. Three hours.

206 Comparative Education. Study of educational policy and practice in selected countries. Focus on the making of citizens, achievement of equity goals, and related development issues in China, Japan, Kenya/Tanzania, and Commonwealth Indepedent States. *Prerequisite:* Twelve hours in education and related areas. Three hours.

209 Introduction to Research Methods in Education and Social Services. Seminars and research projects. Methods of historical, descriptive, experimental, quasi-experimental, field studies, and survey research. Three hours.

255 School as a Social Institution. Examination of the school and related social institutions, focus on themes, including: social class, race, ethnicity, socialization, role of the family, social change. *Prerequisite:* Twelve hours of education and related areas. Three hours.

302 Philosophy of Education. Critical examination of key beliefs and values in current philosophies of helping, e.g. phenomenological, behavioral, holistic, as practiced in a variety of educational and social service institutions. *Prerequisite:* Twelve hours in education and related areas. Three hours.

303 The Ethics of Helping Relationships. Clarification of ethical dimensions of professional rights and obligations for educators, counselors, administrators, other helping professionals. Examination of selected ethical controversies currently facing the helping professionals. *Prerequisite:* Twelve hours in education and related areas. Three hours.

314 Modes of Inquiry. A critical analysis of the various conceptual and methodological foundations of theory and practice in education and the human services. *Prerequisites:* Twelve hours in education and related areas. Three hours.

347 Qualitative Research Methods. Introduces students to qualitative methods as a research paradigm and develops skills in ethnographic techniques of field observation, interviewing, and data analysis. Out-of-class fieldwork required. *Prerequisite:* Master's or doctoral level standing or permission of instructor. Three hours. Glesne.

352 Seminar in Aesthetic Education. A critical examination of aesthetic values in contemporary society. The aesthetic quality of natural and built environment with implications for present and future educational practice given special attention. *Prerequisite:* Twelve hours in education and related areas. Three hours.

354 Anthropological Perspectives on Education and Social Services. Examination of formal and non-formal education as means to produce and alleviate cultural conflict. Incorporates an autobiographical approach to studying socio-cultural implications of schooling and social services. Emphasis on Third World situations. *Prerequisite:* Twelve hours in education and related areas. Three hours.

369 Ethics in Educational and Social Services Administration. Critical examination of theories of ethical decision making. Implications for leadership in educational, social service settings. Ethical investigation utilizing research, scholarship, actual incidents, case studies, role playing. *Prerequisite:* Ed.D. students have priority. Three hours.

455 Social Processes and Educational Institutions. Relationships among ideology, social control, social class, policies, practices within educational institutions. Research related to curricular orientation, evaluation and selection, and school and classroom organization. *Prerequisite:* Doctoral level standing. Three hours.

EDHE—HEALTH EDUCATION

208 School Health Programs. Organization of the total school health program. Problems and administration in the area of school environment, health services, health education, and school-community relationship. *Prerequisite:* 46 or equivalent. Three hours.

211 Community Health Education. Government and voluntary agencies' sociological, historical, educational, environmental, and medical influences. Role of community health educator in these influences and major American health concerns. *Prerequisite:* EDHE 46 or equivalent. Three hours. Pahnos.

220 Stress Management for Health Professionals. Physiological, psychological, and sociological aspects of stress. Theory, practices, teaching techniques, and application relevant to teaching students and/or clients. *Prerequisites:* EDHE 46 or equivalent. Three hours. Pahnos.

EDHI—HIGHER EDUCATION

332 Adult Development and Education. Critical examination of research on adult education, adult learning, development theory, reentry issues facing older students. Analysis and application of proposals for new adult-oriented educational programs. *Prerequisite:* Twelve credits of graduate study in education or permission of instructor. Three hours.

360 Higher Education in America. Critical, contemporary overview of the American university. Implications of conflicting value philosophies for theory, practice of higher education. Three hours.

362 The American College Student. Study of the American college student within the living-learning environment. Emphasis upon sociological and psychological aspects in relation to student personnel work and counseling. *Prerequisite:* Twelve hours in education, psychology, and sociology or related areas. Three hours.

383 Higher Education Administration and Organization. Introduction to concepts of administration and organization as applied to contemporary higher education setting. Characteristics of organizations, dynamic elements of administration, and theories and processes of change. *Prerequisite:* Permission of instructor. Three hours.

385 Student Affairs Profession. Overview of the work of the student affairs profession, including philosophical base, historical development, current practices, and future trends. *Prerequisite:* Enrollment open only to Higher Education and Student Affairs students. Three hours.

387 Seminar in Higher Education. Designed for graduate students concentrating in programs in Higher Education. Analysis and discussion of current issues and problems in higher education. *Prerequisite:* Permission of instructor. One to three hours.

395 Laboratory Experience. Internships, offered in various University departments and offices, enable students to integrate conceptual knowledge with professional practices. *Prerequisite:* Graduate standing in HESA. Two hours.

397 Problems in Higher Education. Research project required for M.Ed. in HESA. Two hours.

EDLI—LIBRARY SCIENCE

272 Public and School Library Services. Relationship to the curriculum, policy, personnel, budget organization, and administration. *Prerequisite:* Twelve hours in education and related areas, or permission of instructor. Three hours.

273 Cataloging and Classification. Descriptive cataloging, subject analysis, processing, acquisition, circulation, and bibliographic formats. *Prerequisite:* EDLI 272 or equivalent. Three hours.

274 Reference Materials and Teaching the Use of Libraries. Evaluation and selection of reference tools, locating reference information, research use, skill in use of library. *Prerequisite:* EDLI 272 or equivalent. Three hours.

275 Selection of Books and Materials for Young Adults. Selection and evaluation of books and other materials used with young adults, techniques for cross-media approach. *Prerequisite:* EDLI 272 or equivalent. Three hours.

276 Reference Sources and Services. Advanced reference skill including theory, technique, administration, bibliographic sources, specialized fields. *Prerequisite:* EDLI 274. Three hours.

277 Library Materials and Services for Media Personnel. Selection, utilization and evaluation of nonprint materials. *Prerequisites:* EDLI 272, 273. Three hours.

278 Cataloging and Organization of Media Materials. Advanced cataloging skills. *Prerequisite:* EDLI 273. Three hours.

279 Selection of Library Materials for Children. Knowledge and use of selection tools criteria and evaluation of materials. *Prerequisite:* EDLI 272 or equivalent. Three hours.

EDLS—LEARNING STUDIES

212 Child and Adolescent Psychology. Children and adults are emerging individuals. Impacts of sociocultural ethics, values, institutions on individuals. Topics: human needs, values, self concept, personal freedom, bureaucratic society, cross-cultural issues. *Prerequisite:* Twelve hours in education and/or related areas. Three hours.

377 Seminar in Educational Psychology. Personal values, attitudes, beliefs related to learning. Psychological research of the teaching-learning process. Research use in analysis of educational processes. Applications for educational settings. *Prerequisite:* Twelve hours in education and related areas. Three hours.

EDMU—MUSIC EDUCATION

240 Musical Creativity in the General Music Class. Designing a course of study for the general music class. Developing musical concepts and perception through individual differences. *Prerequisite:* Permission of instructor. Three hours.

243 Recent Trends in Music Education. Study of recent thought and practices in music education. Examination of current trends. *Prerequisite:* Permission of instructor. Credit valuable, one to four hours.

253 Practicum in Music Education. Current methodology in music education for music specialist and classroom teacher. Each year emphasis in a different area of concentration. *Prerequisites:* Teaching experience, or permission of instructor. Credit variable. Course may be taken for one to four hours each semester and may be repeated for a maximum of eight hours.

290 Basic Concepts in Music Education. Disciplinary backgrounds, historical and philosophical foundations; fundamental consideration of the functions of music in the schools; development of a personal philosophy. Three hours.

390 Organization and Administration of Music Education. Study of the organization and administration of vocal and instrumental music in the public schools. *Prerequisites:* Teaching experience or consent of instructor. Three hours.

EDPE—PHYSICAL EDUCATION

201 Administration of Athletic Program. Background for effective administration of the athletic program of schools. Include scheduling, budgeting, management, equipment, policy, public relations, and education justification. *Prerequisite:* Twelve hours of education and psychology. Three hours.

203 Principles of Physical Education. Principles basic to sound philosophy of physical education for appraisal of historical development; relationship to health education, recreation, and other areas; foundation and functions of physical education. *Prerequisites:* Admission to the program and permission. Three hours.

240 Principles of Motor Learning and Human Performance. Nature of motor learning; factors affecting motor learning (motivation, emotion, stress); concepts of transfer, retention; alternatives in teaching, coaching methodologies based upon applied principles in motor learning. *Prerequisites:* 166, ECHD 62 or 63, or equivalent. Three hours.

241 Seminar in Physical Education and Athletics. Examination and analysis of contemporary issues and trends in physical education and athletics not especially appropriate within the boundaries of an existing course. *Prerequisite:* Twelve hours in physical education and related areas. Variable credit (two to four hours).

253 Curriculum Design in Health and Physical Education. Philosophy, techniques of curriculum innovation in health and physical education. Inter-relationships between student needs and interests, teaching methodology, evaluative procedures, community involvement, administrative organization patterns. *Prerequisites:* 104, 105, 46, 155 or equivalent. Three hours.

260 Adaptive Physical Education. Recognition, prevention, correction of functional, structural deviations from normal body mechanics. Organization of programs adapted to needs of handicapped individuals in both special class and mainstreamed settings. *Prerequisite:* 155, 104, 105 or equivalent teaching experience. Three hours.

EDSC—SECONDARY EDUCATION

217 Secondary School Curriculum. Principles and problems in curriculum development. An analysis of recent curricular innovations in American secondary schools. *Prerequisite:* Twelve hours of education and related areas. Three hours.

223 Reading Programs in Secondary Schools and Colleges. Relationship of reading to learning study of organization, instructional procedures, and materials for developing reading improvement programs for secondary and college students; reading in content areas. *Prerequisite:* Twelve hours in education and/or related areas or consent of instructor. Three hours.

225 Teaching Social Studies in Secondary Schools. Includes multiple teaching modes, questioning techniques, micro-teaching laboratory, analysis of historical content to determine students' prerequisite cognitive skills and processes for construction of historical scenarios. *Prerequisite:* Twelve hours of education and related areas. Three hours.

227 Teaching Science in Secondary Schools. Consideration of science curricula and instructional strategies for grades 7–12. Topics may include: teaching science as problem solving, research in science teaching, affective education through science. *Prerequisites:* Twelve hours in education and related areas or permission of instructor. Three hours.

228 Literature in the Junior-Senior High School Curriculum. (Literary Criticism for Teachers.) Three hours.

229 Communicative Arts in Secondary Schools. (Teaching English in Secondary Schools.) Three hours.

257 Teaching Mathematics in Secondary Schools. Contemporary secondary school mathematics curricula and in-

structional strategies for grades 7–12. Topics may include problem solving, research in mathematics education, use of calculators and computers, manipulatives, and evaluation. *Prerequisites:* Twelve hours in education and related areas or permission of instructor. Three hours.

259 Teaching Foreign Language in the School. (Secondary.) Three hours.

282 Seminar for Prospective Teachers of English. See English 282.

294 Seminar for Prospective Teachers of Communications. See Communication 294.

303-304 Problems and Research in Teaching Secondary School English. See English 303-304.

EDSP—SPECIAL EDUCATION

201 Foundations of Special Education. Examination of historical, current trends in the treatment of individuals with handicaps, including the effects of litigation, legislation, and economic considerations on educational and residential service delivery systems. *Prerequisite:* Twelve hours in education and related areas, or permission of instructor. Three hours.

207 Cooperative Learning. Theoretical and experiential instruction in procedures to increase social acceptance and academic achievement of exceptional learners in mainstream settings through cooperative learning. *Prerequisite:* Permission of instructor. Three hours.

216 Instruction for Individuals with Mild Handicaps. Introduction to curriculum for instruction of children with learning disabilities, mental retardation, behavior disorders. Emphasis on objectives, assessment, task analysis, curriculum, and evaluation. *Prerequisite:* Permission of instructor. Three hours.

217 Instruction for Individuals with Severe Handicaps. Individualized instruction for learners with severe handicaps emphasizing objectives, assessment, task analysis, and behavior analysis. *Prerequisite:* Permission of instructor. Three hours.

221 Family Centered Services for Children with Special Needs. An in-depth study of families of children with special needs; family ecology; interaction and life cycle. Development and implementation of family/professional collaboration strategies. Practicum required. *Prerequisites:* Permission of instructor. Three hours. Fox, Mueller, Yuan.

224 Instruction for Individuals with Mild Handicaps. Students apply principles of behavior analysis to improve academic and social skills of individuals with learning disabilities, mental retardation, behavior disorders. *Prerequisite:* Permission of instructor. Three hours.

228 Advanced Instruction for Individuals with Severe Handicaps. Students apply advanced principles of behavior analysis in the development and implementation of instructional programs for learners with moderate and severe handicaps. *Prerequisite:* Permission of instructor and introductory behavior analysis course. Three hours.

275 Developing Vocational Instruction for Students with Special Needs. See Vocational Education and Technology 275.

290 Curriculum for Individuals with Handicaps. Intensive study of essential curriculum and technology areas related to the development, adaptation, and assessment of students with handicapping conditions. *Prerequisite:* Permission of instructor. Three hours.

296 Special Education Practica for Classroom Teachers. Credit as arranged.

297 Curriculum for Individuals with Handicaps. Students develop and implement a objectives-based curriculum for learners with learning disabilities, mental retardation, behavior disorders, and/or multihandicaps. *Prerequisite:* Permission of instructor.

298 Special Education Practicum. Students provide direct instruction for six learners with learning disabilities, mental retardation, behavior disorders, and/or multihandicaps. *Prerequisite:* Permission of instructor. Credit as arranged.

301 History and Systems of Services for Individuals with Handicaps. Historical and current trends in treatment of individuals with handicaps, including effects of litigation, legislation, economic consideration in education, vocational, residential service delivery systems. *Prerequisite:* Acceptance as candidate for M.Ed. degree in special education, or permission of instructor. Three hours.

302 Physical and Developmental Characteristics of Individuals with Multihandicaps. Normal development — birth through six years, developmental disorders, handicapping conditions. Medical, health considerations for multihandicapped. Management of multihandicapped learner through employment of appropriate handling, positioning, feeding, toileting procedures. *Prerequisite:* Permission of instructor. Three hours.

310, 311 Curriculum and Technology in Special Education. Curricular and assessment areas essential to education of handicapped students. Development, adaptation of curricula and assessment in early education, elementary and secondary and adult levels for mild, moderate, and severe handicapping conditions. *Prerequisite:* Permission of instructor. Three hours.

312, 313 Advanced Behavior Principles in Special Education. A survey on behavior theory and research applications for learners with learning disabilities, mental retardation, behavior disorders, and multihandicaps. *Prerequisite:* Acceptance to M.Ed. program or permission of instructor. Three hours.

316 Research Seminar in Special Education. Research which addresses key issues in special education is reviewed and evaluated. Students write and present a research review with attention to practitioner needs. *Prerequisites:* EDSP 301, 310, 312, a course in quantitative research design. Three hours.

317 Design and Evaluation of Education for Individuals with Severe Handicaps. Students analyze, adapt curricula for severely handicapped, utilizing knowledge of normal, abnormal motor development, feeding techniques, adaptive, prosthetic devices, medial aspects, parent professional partnership, socialization, normalization, legal aspects. *Prerequisite:* Permission of instructor. Three hours.

319 Internship for Specialized Personnel in Education. Approved internship reflecting student's interest and needs. Competency-based instruction in development, implementation of effective programs for learners eligible for special education services. *Prerequisite:* Permission of instructor. Credit as arranged.

320 Laboratory Experience in Education: Educational Programming for Students with Severe Handicaps. Students identify, evaluate severely handicapped learners, demonstrate competency in handling, positioning, feeding. Current skill levels assessed, educational programs designed, including objectives, teaching/learning procedures, evaluation, measurement. *Prerequisites:* Master's degree or equivalent, permission of instructor. Three hours.

322 Internship in Special Education: The Triadic Model of Consultation. Competency-based instruction in oral and written communication, consultation, and workshop level training is provided. Students apply the consultation model in an educational setting. *Prerequisites:* EDSP 310, 312 or permission of instructor. Three hours.

323 Internship in Special Education: Systems Development. Competency-based instruction in planning for system level development and change. Students apply systems theory in an educational setting. *Prerequisites:* EDSP 310, 312 or permission of instructor. Three hours.

384 Teaching-Internship in Special Education: Course Development and Implementation. Instruction in developing competency-based courses in special education for inservice teacher training. Practicum involves team teaching with University special education faculty. *Prerequisites:* Certification as a Consulting Teacher/Learning Specialist and permission of instructor. Six hours.

385 Teaching Internship: Advanced Systems Development and Management in Special Education. Competency-based instruction in developing and adapting technological programs for advanced system-level change. *Prerequisite:* EDSP 319 (six hours), permission of instructor. Three to six hours.

386 Teaching Internship: Management of Learning Environments for the Handicapped. Implementation of data-based individualized education in one-to-one, small group, and large group instruction for severely handicapped student(s) in special or regular classrooms. *Prerequisites:* EDSP 217, 290, 228 or permission of instructor. Variable credit.

EDSS—EDUCATION

211 Educational Measurements. The essential principles of measurement in education. Topics include validity, reliability, principles of test construction, item analysis, and analysis of standardized tests as they apply to the classroom. *Prerequisite:* Twelve hours in education and related areas. Three hours.

215 The Gifted Child. Three hours.

238 Teaching for Global Awareness. Ways of teaching about global issues: peace and prevention of war, social, economic justice; environmental harmony. Development of curriculum materials. Links between local and global concerns. *Prerequisite:* Twelve hours of education and related areas. Three hours.

245 Applications of Microcomputers in Elementary and Secondary School Curricula. For elementary, secondary educators with experience in simple programming. Design of instructional procedures, integrating computers into school curriculum. Use of computer software to teach basic skills, reasoning, thinking skills. *Prerequisites:* Computer Science 3 or equivalent, permission of instructor. Three hours.

248 Educational Media. Modern instructional aids, theory and practice, educational media related to psychology of teaching and learning. *Prerequisite:* Twelve hours in education and related areas. Three hours.

261 Current Directions in Curriculum and Instruction. Current trends, issues, literature, programs, and organizational activities in fields of curriculum and instruction emphasizing areas of individual concern. Focus on elementary and secondary school levels. *Prerequisite:* Twelve credits in education or equivalent. Three hours.

309 Interdisciplinary Seminar: Social Policy, Education, Social Services. Introduction to interdisciplinary study; the field of policy analysis and social change. Core academic experience for Interdisciplinary Majors. *Prerequisites:* Interdisciplinary majors; others by permission. Three hours.

313 Statistical Methods in Education and Social Services. Basic concepts of descriptive and inferential statistics. Topics: frequency distributions; measures of central tendency, dispersion; correlation, hypothesis testing. Application of concepts to educational situations. Three hours.

321 School Improvement: Theory and Practice. Analysis of research and practices pertinent to improvement of American schools. Student assignments include synthesis papers and site-specific research projects derived from course studies. *Prerequisite:* Twelve hours of graduate study in education. Four to six hours.

333 Curriculum Concepts, Planning and Development. Overview of conceptions of curriculum for elementary and secondary education; examination of contemporary curriculum trends, issues; processes for initiating, planning, developing curriculum activities and programs. *Prerequisite:* Twelve hours of education or permission of instructor. Three hours.

336 Professional Writing. Problems in writing faced by professionals in educational and human service settings. Students write reports, critiques, reviews; analyze examples of published work; receive detailed critiques of their work. Three hours.

343 The Study of Teaching. Study of the art and science with emphasis on students' own teaching. Current research on teaching and self-study are major foci. *Prerequisites:* Twelve hours of education, teaching experience. Three hours.

363 Seminar in the Analysis of Curriculum and Instruction. A case study analysis of the design, implementation, and evaluation of selected curricular and instructional improvements. *Prerequisites:* Ed.D. students have priority. Three hours.

349 Quasi-Experimentation in Education and Social Services. Quasi-experimental designs are analyzed, compared, and contrasted with "true experiments." Strategies for addressing threats to the validity of quasi-experiments are studied. Design exemplars are evaluated. *Prerequisite:* EDSS 313, or Psychology 340, or Statistics 211, or equivalent. Three hours.

Electrical Engineering (EE)

Professors Absher, Anderson, Evering, Golden (Chairperson), Mirchandani, Oughstun, Williams; Professor Emeritus Rush; Associate Professors Fuhr, Titcomb; Assistant Professors Schwartz, Snapp, Stavrakakis, Varhue; Lecturers Bonaccio, El-Kareh (part-time).

Master of Science and Doctor of Philosophy programs are offered. Candidates normally have obtained the Bachelor of Science degree in Electrical Engineering prior to application for admission but other applicants are encouraged to consider the program if they have extensive background in mathematics and the basic sciences. In such cases, it may be necessary for a student to complete the entrance qualifications without receiving credit toward graduate studies. The general requirements for admission as outlined under the "Regulations of the Graduate College" must be met. Areas of research expertise are control systems, biomedical engineering, plasma physics, solid state physical electronics, electro-optics, information processing, communication theory, semiconductor materials, devices and integrated circuits (VLSI).

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

An accredited bachelor's degree in an appropriate field.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

An accredited bachelor's degree in electrical engineering or equivalent education.

MINIMUM DEGREE REQUIREMENTS

Advanced courses in electrical engineering, physics, and mathematics (18 to 24) with at least 15 credit hours appropriately distributed in approved areas of study in the Computer Science and Electrical Engineering Department; thesis research (six to 12 hours).

Although a thesis is normally required in the program leading to the M.S. in Electrical Engineering, the thesis may be waived with departmental approval, in favor of additional courses. In such cases, the student will be expected to have considerable professional experience, or to submit high quality technical reports as evidence of professional maturity.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

A master's degree in electrical engineering or the equivalent.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Successful completion of Ph.D. comprehensive examinations.

The majority of students will have completed a core program comprising graduate courses before taking the comprehensive examination.

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

At least 45 credit hours in courses and seminars and 30 credit hours in dissertation. Normally, nine additional credit hours in an area of specialization are found necessary. The requirements specified under the "Policies of the Graduate College" must also be met.

COURSES OFFERED

201 Linear System Theory (3-0). Basic concepts in system theory; linear algebra; state space representation; stability; controllability; and observability. Applications of these concepts. *Prerequisite:* 171 or Graduate standing. Three hours.

209 Transient Phenomena (3-0). Complex variable basis of Laplace and Fourier Transforms; applications to transient behavior of lumped and distributed parameter systems, root locus. Nyquist criterion, two-dimensional field problems. *Prerequisites:* 4, Math. 121 or equivalent. Three hours.

221 Principles of VLSI Digital Circuit Design (2-3). The design, layout, and simulation of VLSI digital circuits. Emphasis on custom, laboratory design; typical topics will include memory, PLA, ALU, and elemental arithmetic circuits. *Prerequisites:* 121, 131, 163 or equivalent. Three hours.

222 Principles of VLSI Analog Circuit Design. The design, layout and simulation of VLSI analog circuits. emphasis on small signal models and circuits used in operational amplifiers. *Prerequisites:* 121, 163, permission of instructor. Three hours. Staff.

227 Biomedical Measurements, Instrumentation, and Systems. Biomedical and clinical engineering in research, industry, and healthcare institutions. Measurement techniques and instrumentation. Integrated biomedical monitoring, diagnostic, and therapeutic systems. *Corequisites:* 121, Physiology and Biophysics 101, and instructor's permission. Three hours.

231, 232 Digital Computer Design (3-0). Hardware components, design, organization, realization. Design concepts, procedures, design of small computer. Microprogrammed control units, memory organization, hardware realization of high-speed arithmetic operations. Interrupt, I/O systems, interfacing, intersystem communications. *Prerequisite:* Departmental permission. Three hours.

233 Microprocessor-Based Systems and Applications. Basic principles of mini-microcomputers; A/D; D/A; channels, magnetic devices, display devices, mechanical devices; interface designs of analog systems to mini/microcomputers; principles of microprogramming; bit-slice-based microcomputers. *Prerequisite:* Departmental permission. Computer Science 101 desirable. Four hours.

240 Boundary Value Problems in Electromagnetism (3-0). Problems of Electromagnetism emphasizing Helmholtz theorem, uniqueness theorems, and numerical methods. *Prerequisite:* 141 or equivalent. Three hours.

242 Electromagnetic Theory II. Macroscopic Maxwell theory, boundary conditions and dispersion relations for spatio-temporal fields. Electromagnetic wave propagation, reflection and transmission, guides waves, radiation, scattering and diffraction phenomena. *Prerequisite:* 240 or permission of instructor. Three hours.

245 Lasers and Electro-Optical Devices (3-0). A theoretical description of light-matter interactions in photon emitting resonant cavities and a practical understanding of laser design and operation. *Prerequisites:* 141, Physics 128, permission. Three hours.

246 Engineering Optics. Applications of optics to the solution of engineering problems. Optical signal processing, fiber optic sensors, integrated optics. *Prerequisites:* 245 or permission of instructor. Three hours.

261 Solid State Materials and Devices I. Energy band theory, effective mass, band structure effect on electronic properties of solids. Transport of electrons and holes in bulk materials and across interfaces. Homojunctions, heterojunctions, Schottky barriers. *Prerequisite:* 163 or equivalent. Three hours.

262 Solid State Materials and Devices II. Multijunction and interface devices. Heterostructure and optical devices. Dielectric and optical properties solids. High-frequency and high-speed devices. *Prerequisite:* 261. Three hours.

266 Science and Technology of Integrated Circuits (3-0). Science and technology of integrated circuit fabrication, interaction of processing with material properties, electrical performance, economy, and manufacturability. *Prerequisites:* 163 or 261 and concurrent registration in 164 or 262. Three hours.

270 Probability Theory and Stochastic Processes. Probability theory, random variables, and stochastic processes. Response of linear systems to random inputs. Applications in electrical engineering. *Prerequisite:* 171 or equivalent. Three hours. Cross-listing: Statistics 270.

271 Least Squares Estimation and Filtering. Foundations of linear and nonlinear least squares estimation, smoothing and prediction computational aspects, Kalman filtering, nonlinear filtering, parameter identification, and adaptive filtering. *Prerequisites:* 201, 270. Three hours. Cross-listing: Statistics 271.

275 Digital Signal Processing and Filtering (3-3). Sampling aliasing, and windowing. FIR and IIR filters. DFT and FFT. Linear predictive coding. Vocoders. Digital simulation and implementation using real-time processors and evaluation modules. *Prerequisites:* 171, permission. Four hours.

276 Image Processing and Filtering (3-3). Image sampling, quantization and reconstruction. Discrete two-dimensional transforms and linear processing techniques. Image enhancement and restoration methods. Implementation and simulation using real time and interactive image processing in the lab. *Prerequisite:* 275. Four hours.

277 Image Analysis and Pattern Recognition (3-0). Image, shape, and texture analysis. Statistical pattern recognition methods. Pattern recognition and computer vision techniques for machine parts recognition and automatic visual inspection. *Prerequisite:* 276. Three hours.

281 through 284 Seminars (1-0). Presentation and discussion of advanced electrical engineering problems and current developments. *Prerequisite:* Senior or graduate engineering enrollment. One hour.

285 Engineering Design Analysis and Synthesis. Advanced engineering problem solving, analytical techniques and simulations involving control systems, digital electronics, computer hardware and software; technical writing and documentation emphasized. *Prerequisite:* Graduate standing in EE or departmental permission. Three hours.

295 Special Topics. Formulation and solution of theoretical and practical problems dealing with electrical circuits, apparatus, machines, or systems. *Prerequisites:* 4, permission of instructor. Three hours.

311, 312 Introduction to Optimum Control Systems (3-0). Review of conventional design methods. Introduction to optimal control problem formulation and solution; including the calculus of variations. Pontryagin's maximum principle, Hamilton-Jacobi theory. Dynamic Programming, and other computational methods. *Prerequisites:* 110; 311 for 312. Three hours.

314, 315 Nonlinear System Theory (3-0). Basic nonlinear methods including computational and geometrical techniques for analysis of nonlinear systems. Describing function methods and bifurcation and catastrophe theory. Sensitivity and stability considerations. *Prerequisite:* 201 or Math. 230. Three hours.

338 Semiconductor Device Modeling and Simulation. Analysis and application of computer models for semiconductor process and device simulation. Strategies for development of device models for circuit simulation. *Prerequisites:* 262, permission of instructor. Three hours.

340, 341 Special Topics in Electromagnetic Field Theory (3-0). For advanced students in the field of electromagnetism. Topics selected from special interests of staff with lectures and readings from current literature. Three hours.

347 Optical Field Theory I. Electromagnetic theory of the optical field. Molecular optics and the Ewald-Oseen extinction theorem. The eikonal equation, propagation in inhomogeneous media. Diffraction and aberration theory. *Prerequisites:* 240, 242. Three hours.

348 Optical Field Theory II. Classical theory of coherence and statistical optics. The Van Cittert-Zernike theorem, partial coherence. Rigorous diffraction theory, the optics of metals and crystal optics. *Prerequisites:* 270, 347. Three hours.

352 Advanced Semiconductor Device Physics and Design. MOSFET, bipolar, and CMOS device parameters, their characterization, and their relation to process technology. Description and use of computer-aided process and device models. *Prerequisite:* 262. Three hours. Alternate years. Spring semester. Anderson, El-Kareh, Titcomb.

354 MOS Analog Integrated Circuit Design (3-0). Analysis and design of MOS analog integrated circuits. Each student will design, layout, test, and document an analog integrated circuit using computer-aided-design techniques. *Prerequisites:* 338, 339. Three hours.

365 Optical Properties of Solids (3-0). Optical and optoelectronic properties of semiconductors. Applications to photodetectors, solar cells, light emitting diodes and lasers. *Prerequisites:* 242, 262, Physics 273. Three hours.

366 Solid State and Semiconductor Theory I (3-0). Energy band theory for electrons and phonons in crystalline solids. Brillouin zones. Conservation laws. Elements of statistical mechanics. Transport properties. Applications to semiconductor electronics. *Prerequisites:* 261, Physics 273 or Chemistry 263. Three hours.

373, 374 Digital Communication (3-0). Modulation and coding in digital communication systems. Baseband pulse transmission. Linear modulation systems. Digital FM and PM. Error-correcting codes: block codes and convolution codes. Applications. *Prerequisites:* Graduate standing in EE or 174; 373 for 374. Three hours.

378 Special Topics in Statistical Communication and Related Fields. Coding for communication or computer systems, pattern recognition and learning machines, artificial intelligence, etc., selected from special interests of staff with lectures and readings from current literature. *Prerequisite:* Graduate standing in EE. Three hours.

391 Master's Thesis Research. Credit as arranged.

395 Advanced Special Topics. Advanced topics of current interest in electrical engineering. *Prerequisites:* Graduate standing, permission of instructor. Credit as arranged. Staff.

491 Doctoral Dissertation Research. Credit as arranged.

The following courses are offered infrequently but may be taught where sufficient student interest is demonstrated.

251 Applications of Linear Algebra. Three hours.

272 Information Theory. Three hours.

317, 318 Theory of Optimum Control Systems. Three hours.

319, 320 Special Topics in Control System Theory. Three hours.

345 Electromagnetic Antennas and Propagation. Three hours.

367 Solid State and Semiconductor Theory II. Three hours.

Engineering Physics

A program of advanced study in physics and engineering to prepare students for research and development positions in mission-oriented organizations. Advanced courses in both physics and engineering are required as is a comprehensive examination and a thesis based upon the application of physical principles to a real or simulated engineering problem. A nonthesis option is available to students who have already demonstrated ability to perform research and report the results in written and oral form.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

Students with an accredited bachelor's degree in computer science, engineering, applied mathematics, or physics are normally considered for admission to the program. Submission of scores on the general (aptitude) Graduate Record Examination is required.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

The student is expected to have completed the following courses: Math. 271, 272 (applied mathematics), ME 50 or Physics 211 (intermediate mechanics), ME 101 (materials engineering), Physics 265, ME 41, or ME 115 (thermal sci-

ence), Physics 213, 214 or EE 143, 144 (electromagnetism), Physics 273 (quantum mechanics), Physics 242 or EE 263, 264 (solid state physics).

Since these are prerequisites to the degree program, and not the program itself, any of these course prerequisites may be replaced by a demonstration of equivalent knowledge of their content, to the satisfaction of the Studies Committee.

Demonstrated ability to program scientific or technical problems in Fortran, or an equivalent language.

MINIMUM DEGREE REQUIREMENTS

Thesis Option
Completion of 30 credits of study approved by the Studies Committee, which must include Physics 341, 342, and 362, not fewer than six credits in graduate engineering courses, and six credits in Physics 391 (thesis research). This option requires submission of a thesis based on an independent investigation demanding the application of physical principles to a real or simulated engineering problem approved by the Studies Committee.

Nonthesis Option
Students who are offered the nonthesis option must elect to replace the requirement of Physics 391 with Physics 381, 382.

Examinations
All students are required to pass the regularly offered Physics Comprehensive Examination, administered annually *circa* the end of May. Students submitting a thesis (Physics 391) must pass the usual Thesis Examination.

English (ENGL)

Professors Bradley (Chairperson), Broughton, Clark, Eschholz, Fulwiler, Gutman, Huddle, Orth, Poger, Rosa, Rothwell, Shepherd, Stephany, Thompson; Associate Professors Biddle, A.I. Dickerson, Edwards, Hall, Magistrale, Mzamane, Simone, Stanton, Warhol (Director of Graduate Studies); Assistant Professors M.J. Dickerson, Lin, Schnell, Sweterlitsch, Winter.

The research interests of the faculty of the Department of English and library resources permit graduate students to undertake thesis subjects in virtually all fields of the discipline.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF ARTS

An undergraduate major in English or its equivalent; satisfactory scores on the general (aptitude) and subject (literature in English) Graduate Record Examinations; demonstration of proficiency in writing by a detailed statement concerning the purpose in pursuing graduate study in English. If admitted conditionally the student must complete satisfactorily a stipulated number of hours (usually six) of graduate level work.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF ARTS

Satisfactory completion of 18 hours of appropriate credit.

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS

Thesis Option
Completion of 24 hours of course work, including English 302, 311, 315 or 316, 318, 371, and at least nine additional hours (at least three of these nine in English or Humanities, at most six in related fields). Candidates must submit a customized reading list, pass a comprehensive exam based on it, and complete six additional hours by writing an acceptable thesis and defending it successfully.

Nonthesis Option
Completion of 30 hours, including English 302, 311, 315 or 316, 318, 371 and at least fifteen additional hours (at least nine of these in English or Humanities, at most six in related fields). Candidates must pass a three-part comprehensive examination based on set Departmental reading lists, and must receive a grade of B+ or better on two seminar papers submitted to an *ad hoc* faculty Reading Committee.

Both Options
All M.A. candidates in English must demonstrate a reading knowledge of a foreign language by examination or by advanced coursework.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF ARTS IN TEACHING

See page 20.

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN TEACHING

Thirty credit hours of course work; 24 in English (including English 302, 311, 315 or 316, 318, 371, and nine additional hours of course work in English—up to six of these in a related field), plus a comprehensive examination in English. Also, a minimum of 30 semester hours of undergraduate and graduate education courses numbered above 200, of which not fewer than six hours must be taken at UVM, plus a comprehensive examination in education. See page 20 for further details.

COURSES OFFERED

At the 200 level, the Department of English offers several seminars each semester which are numbered as described below. The specified topics vary each semester, depending on the instructors assigned. However, over the normal course of a graduate student's program, every member of the department's graduate faculty will offer a seminar in his/her area of special interest and expertise.

201, 202 Seminar in Language, Criticism, or Rhetoric.

211, 212 Seminar in British Literature to 1660.

221, 222 Seminar in British Literature, 1660–1900.

231, 232 Seminar in Modern British Literature.

241, 242 Seminar in American Literature to 1900.

251, 252 Seminar in Modern American Literature.

261, 262 Seminar in Literary Themes, Genres, or Folklore.

282 Seminar for Prospective Teachers of English. Approaches to teaching composition, literature, and the English language in secondary school. This course does not satisfy the requirement for English majors of one 200-level seminar. Three hours. Biddle.

295, 296 Advanced Special Topics. Advanced special topics or seminars in English beyond the scope of existing formal courses. *Prerequisites:* Graduate or advanced undergraduate standing. Permission of instructor. Three hours.

297, 298 Readings and Research. For advanced undergraduate and graduate students. *Prerequisite:* Departmental permission. Not to exceed three hours per semester.

301 Structure of the English Language. A descriptive study of Modern American English. Three hours. Clark.

302 Graduate Seminar. Graduate students only. Topic varies from semester to semester, depending on faculty mem-

ber teaching the course. One seminar is required of all graduate students in English. Three hours.

303, 304 Problems and Research in Teaching Secondary School English. Consideration of problems, curricular materials, teaching procedures, and research methods in secondary school language, literature, and composition. *Prerequisites:* Twelve hours of education; acceptance as qualified to earn graduate credit in English. Three hours. Biddle.

311 Chaucer. Study of the principal works of Chaucer, emphasizing Chaucer's literary scope, talents, and position in medieval literature. Three hours. A.I. Dickerson, Stephany.

315, 316 Shakespeare. Three hours. Rothwell, Simone.

318 Milton. Study of *Paradise Lost, Paradise Regained, Samson Agonistes,* minor poems, and selected prose works. Three hours.

371 Principles of Literary Research. Methods of literary study, research, and scholarship. Required of all M.A. candidates in English. Three hours. Orth.

391 Master's Thesis Research. Credit as arranged.

397, 398 Special Readings and Research. Directed individual study of areas not appropriately covered by existing courses. Not to exceed three hours.

Environmental Studies (See page 103.)

Forestry

For descriptions of the M.S. Program in Forestry, see NATURAL RESOURCES, page 79.

French (FREN)

Professors Carrard (Director of Graduate Studies), Whatley; Associate Professors Crichfield, T. Geno, Kuizenga (Chair), Senécal, Van Slyke; Assistant Professor Whitebook.

Opportunities for thesis research in French literature are offered in all areas from the medieval through the 20th century, as well as French-Canadian literature and African literature of French expression.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF ARTS

An undergraduate major in French or equivalent. Satisfactory scores on the general (aptitude) Graduate Record Examinations.

MINIMUM DEGREE REQUIREMENTS

Twenty-four hours in French, which may include six hours in a related field, and in addition:

Plan A: Thesis research (six hours).
Plan B: Two research papers (six hours).

A program is also offered leading to the degree of Master of Arts in Teaching. Satisfactory scores on the general (aptitude) Graduate Record Examinations are requirements for admission to graduate studies for the M.A.T.

COURSES OFFERED

The following courses are available for graduate credit. They are divided into courses concerned primarily with advanced language study and those which treat literature. In literature, the 200-level courses, open to both undergraduates and graduates, cover the history of French literature from its origins to the present time by means of division into centuries and genres. Emphasis is placed on major figures and works, with a view to studying them for their intrinsic value as well as in their historical context. For more detailed information on specific courses, consult with department chairperson and the course instructor.

French Language

209 Advanced Grammar. Comparative grammatical study centered on the specific problems encountered by Anglophones in written and spoken French. Three hours. Carrard, van Slyke.

210 Romance Philology. Development of French, Spanish, and Italian from Latin. Study of documents. *Prerequisite:* Intermediate level or equivalent in at least two of the languages, or permission. Taught in English. Three hours. Whitebook.

215 Methods of Text Analysis. Introduction to procedures and terminology used in analysis of texts of various genres. Three hours. Carrard.

216 Stylistics. Study of idiomatic difficulties faced by people who learn French; translation; analysis of the various "levels of speech" in French, with their stylistic features. Three hours. Carrard.

French Literature and Civilization

225 Medieval French Literature. First semester; Old French Language; 12th century epics, e.g. *La Chanson de Roland, Le Pelerinage de Charlemagne,* Breton lays; Marie de France. Three hours. Whitebook.

226 Medieval French Literature. Second semester: Romances: Chrétien de Troyes, Guillaume de Lorris and Jean de Meung; lyric poetry, Machaut; Pisan; Charles d'Orléans; farces and miracles. *Prerequisite:* 225. Three hours. Whitebook.

235 Literature of the French Renaissance. Readings in fiction, poetry, and essays: Rabelais; the lyric poets Louise Labe', Ronsard, and Du Bellay; the tales of Marguerite de Navarre; Montaigne. Three hours. Kuizenga, Whatley.

245 The Baroque Age, 1600–1650. The literature after France's civil wars, up to the triumph of classicism: religious, lyric, and political poetry; idealistic, picaresque and fantastic novels; baroque drama; Pascal. Three hours. Whatley.

246 17th Century. Selected works of the Century emphasizing Corneille, Racine, and Molière. Three hours. Kuizenga.

247 Molière. A study of the major portion of Molière's comic creation as classical French theatre and literature. Three hours. T. Geno. Cross-listing: Theatre 229 (not for graduate credit).

255 18th Century Literature. Writers of the early Enlightenment. Possible topics: the impact of the new science; the literary reflection of new social types; the "pursuit of happiness." Three hours. Whatley.

256 18th Century Literature. Rousseau, Diderot, Laclos, Sade: the generation before the Revolution. Possible topics: the attempts to define "natural man;" the relationship between the arts and morality, between liberty and libertinism. Three hours. Whatley.

265 19th Century Literature. Discourses of knowledge through imagination, instinct, emotion in early manifestos, romantic writers, symbolists and *fin de siècle* decadents. Representative authors: Stael, Hugo, Flaubert, Rimbaud, Mallarme'. Three hours. Crichfield.

266 Revolution and Reaction in 19th Century Narrative.

Study of the representations of major social issues of the period, such as power, class, money and women. Representative authors: Balzac, Flaubert, Sand, Stendhal, Zola. Three hours. Crichfield.

275, 276 20th Century Literature. Selected topics dealing with poetry and/or narrative related either to an historical period or a literary movement. Three hours. Carrard.

277 Topics in 20th Century French Theatre. Subjects may include: *le théâtre traditionnel, le théâtre "de l'absurde", le théâtre de la marge,* a combination of all the above. Each may be repeated up to six hours. Three hours. T. Geno.

285 Québec Literature I. A study of contemporary (1960–1985) major works of fiction, poetry, and drama. Authors studied include Anne Hébert, Michel Tremblay, Jacques Godbout, Gaston Miron. Three hours. Senécal.

286 Québec Literature II. A continuation of 285, encompassing fiction, poetry, and theatre from 1940 to 1975. Three hours. Senécal.

289 African Literature of French Expression. Study of West African poetry, theatre, novel, and civilization as an expression of the Black experience in the language of the French colonizer. Three hours. T. Geno.

290 Contemporary French Thought: The Linguistic Model. Study of the model of structural analysis established by Saussure and its adaptation to other domains of contemporary thought such as anthropology, psychoanalysis and philosophy. Taught entirely in French. Three hours. van Slyke.

291 Civilization of France. A study of the evolution of French institutions in their geographic, political, social, economic, and intellectual contexts from the Middle Ages to the Second World War. Three hours.

292 Contemporary Civilization of France. A study of French institutions and daily life since the Second World War, emphasizing the most recent changes. (French 291 or History 53 or 153 strongly recommended.) Three hours.

293 Québec Culture. Sociocultural study of the French civilization of Canada. Three hours. Senécal.

295, 296 Advanced Special Topics.

297, 298 Advanced Readings and Research.

391 Master's Thesis Research. Credit as arranged.

Geography (GEOG)

Professors Gade, Meeks, VanderMeer; Associate Professors Barnum, Bodman (Chairperson), Lind; Assistant Professors Kennedy, Seager.

Faculty research interests include most systematic aspects of geography, especially from an historical perspective. Technique interests are in cartography, remote sensing, and quantitative methods. Regional interests and field experiences are almost world-wide in scope.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF ARTS

Evidence of a strong interest in geography. Satisfactory scores on the general (verbal and quantitative) portion of the Graduate Record Examination.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF ARTS

Twelve semester hours or its equivalent in geography and supporting courses in related fields or demonstrated proficiency in geography which would be assurance of success in graduate study.

MINIMUM DEGREE REQUIREMENTS

Twenty-one hours in geography courses including 201, 287, or a reading knowledge of a foreign language, and six hours of thesis research (391); nine additional hours in geography or a related field. For additional information, please write to the Graduate Program Coordinator, Department of Geography.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF ARTS IN TEACHING

See page 20.

COURSES OFFERED

Admission to the following courses for graduate credit requires the approval of the Graduate Program Coordinator in geography.

201 Perspectives on Geography. Geographic concepts and research methodology; the formulation, conduct, and presentation of a research effort. Three hours.

210 Special Topics in Regional Geography. Specialized study of a particular region. *Prerequisite:* Permission of instructor. Three hours.

216 Biogeography. Processes and patterns of distribution, domestication, and human utility of plant and animal species and communities in varying environmental and historical contexts. *Prerequisite:* Nine hours in geography or biology. Three hours. Gade.

233 Rural Planning. (See Agricultural and Resource Economics 233.)

242 Problems in Physical Geography. Three hours. Gade, Lind, Meeks.

261 Problems in Vermont Geography. Three hours.

270 Problems in Human Geography. Three hours. Barnum, Bodman, Gade, Kennedy, Meeks, Seager, VanderMeer.

281 Problems in Cartography. Special laboratory projects. *Prerequisite:* 81 or equivalent. Three hours. Kennedy.

285 Remote Sensing and Environmental Problems. (Same as Geology 274.) Research projects in remote sensing; application of multispectral data for environmental studies. *Prerequisite:* 85 or equivalent. Three hours. Lind.

287 Spatial Analysis. (Same as Agricultural and Resource Economics 287.) Analysis of spatial pattern and interaction through quantitative models; introduction to measurement, sampling, and covariation in a spatial framework. *Prerequisite:* Graduate standing in geography or planning. Three hours. Bodman, Kennedy.

295, 296 Advanced Special Topics. Advanced courses or seminars beyond the scope of existing departmental offerings. Three hours. Staff.

297, 298 Readings and Research. Credit as arranged.

300 Graduate Tutorial. Readings and research on topics arranged individually by students with instructors; attendance in appropriate undergraduate courses may be required. *Prerequisite:* Permission of instructor. Three hours.

391 Master's Thesis Research. Credit as arranged.

Geology (GEOL)

Professors Cassell, Hunt, Stanley; Associate Professors Bucke, Doolan, Drake, Hannah (Chairperson), Mehrtens; Adjunct Professors Jaffe, Stein, Wright.

Research programs include sedimentary, metamorphic,

and igneous environments, and structure and stratigraphy of the northern Appalachians and western Cordillera. Specific faculty interests include the tectonic evolution of deformed continental margins; petrogenesis and P-T-t paths of mafic schists; petrofabric and structural analysis of deformed rocks; petrology and modal analyses of lower Paleozoic sandstones; petrochemical, stable isotope, and fluid inclusion studies of igneous rocks and related ore deposits; low-temperature, low-pressure geochemistry; geologic history and recent sedimentation in Lake Champlain; evolution, ecology and ontogeny of invertebrate fossils. Interdisciplinary studies are available. Thesis topics should be in accord with faculty interests.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

An undergraduate major in an appropriate field: 12 semester hours in geology; satisfactory scores on the general (aptitude) Graduate Record Examination. Year courses in chemistry, physics or biology, and calculus or in an approved ancillary science strongly recommended.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

Satisfactory completion of one year of graduate study plus a comprehensive examination.

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

Thesis and advanced courses in geology must total at least 30 semester hours, including at least one 300-level course. Advanced courses in related sciences are encouraged and may be substituted for some selected geology courses on approval by the departmental advisor. All students must complete successfully a course in field geology before graduation. This can be satisfied by Geology 201, or a comparable course at another institution, or recognized experience with a state survey, U.S. Geological Survey, an oceanographic institute, a geolimnological group or industry. Satisfactory completion will be determined by the Departmental Studies Committee.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE FOR TEACHERS

1. A bachelor's degree from an accredited institution;
2. Certification as a teacher of a physical or natural science;
3. Satisfactory scores on the Graduate Record Examination (general portion).

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE FOR TEACHERS

Satisfactory completion of one year of graduate study plus departmental recommendation.

MINIMUM REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN TEACHING (GEOLOGY)

Thirty hours of course work that will strengthen the student's background in earth science. Up to 12 hours of 100-level courses may be chosen if applicable. Course work may be chosen from supporting subject areas as well as from geology. Each student, in conference with an advisor, will develop a program suited to his/her needs and background. No thesis is required; however, each degree recipient must complete a general written or oral examination.

A program is also offered leading to the degree of Master of Arts in Teaching (see page 20).

COURSES OFFERED

201 Advanced Field Geology (1–6). Advanced field mapping techniques, analysis of field data, preparation of geological maps and reports. *Prerequisite:* 260 or equivalent. Three hours. Doolan, Hannah, Mehrtens, Stanley.

220 Invertebrate Paleontology (2–3). Classification, geological distribution, evolution, paleoecology, and morphology of major invertebrate fossil groups. *Prerequisites:* 121, Biology 1, or equivalent. Three hours. Hunt.

230 Advanced Igneous and Metamorphic Petrology (3–3). Application of phase equilibria, elemental and isotopic data, and textural interpretations to problems in igneous and metamorphic petrology, stressing modern theories of tectonics and petrogenesis. *Prerequisites:* 131 or equivalent. Four hours. Doolan, Hannah.

235 Geochemistry of Natural Waters. Basic concepts of chemical equilibria applied to natural waters, including thermodynamics, pH, oxidation-reduction, weathering, and solution equilibria. *Prerequisites:* 110, Chemistry 1, 2 or permission of instructor. Three hours. Drake.

237 Economic Geology. Distribution and mode of occurrence of principal metallic ores; petrographic and geochemical tools used to develop models of ore genesis. *Prerequisites:* 101, 131 or equivalent. Three hours. Hannah.

241 Clastic Depositional Systems. Selected readings and field studies emphasizing the interpretation of clastic sedimentary deposits including transportation, processes of sedimentation, and geomorphology of ancient and recent sedimentary environments. *Prerequisites:* 153 or equivalent. Three hours. Mehrtens. Alternate years.

243 Clastic Petrology Laboratory. The study of clastic rocks in hand specimen and thin section. *Prerequisite:* Concurrent enrollment in 241. One hour. Mehrtens.

245 Carbonate Depositional Environments. Paleoenvironmental analysis of carbonate rocks including selected readings, field investigations, and petrographic studies. *Prerequisite:* 153 or equivalent. Three hours. Mehrtens. Alternate years.

247 Carbonate Petrology Laboratory. The study of carbonate rocks in hand specimen and thin section. *Prerequisite:* Concurrent enrollment in 245. One hour. Mehrtens.

251 Recent Sedimentation (1–6). Investigation of recent sedimentary environments using geolimnological and oceanographic techniques. Groups and individual projects. *Prerequisite:* 153 or equivalent. Three hours. Hunt.

252 Soil Classification and Land Use. (See Plant and Soil Science 261.)Three hours.

256 Geology of Oil and Gas (2–3). Origin, migration, and entrapment of petroleum. Geology and classification of source and reservoir rocks and traps. Methods of subsurface basin analysis. *Prerequisite:* 153 or equivalent. Three hours. Bucke.

260 Structural Geology (3–3). Rock deformation, description, and geometry of structural types, and the interpretation of structures of all sizes in terms of finite strain and causal stress fields. *Prerequisite:* 101, 110, Physics 11 or permission. Four hours. Stanley.

270 Toxic and Hazardous Substances in Surface and Ground Water. (See Natural Resources 270.) Three hours.

271 Effect of Human Activities on the Lake Champlain Ecosystem. (See Natural Resources 271.) Three hours.

272a, b Regional Geology. 272a (one credit): Discussion of the geology of a selected region of North America; 272b (three credits): A four-week summer field trip to the area in question. *Prerequisites:* 101, 110; 272a for 272b or equivalent. Four hours.

273 Geology of the Appalachians. Origin of mountain

belts; the Appalachian mountain system discussed in terms of tectonics and geologic processes active in modern continental margins. *Prerequisites:* 101, 131 or equivalent. Three hours. Doolan.

274 Remote Sensing of the Environment. (See Geography 285.) Three hours.

276 Water Quality Analysis and Interpretation. (See Natural Resources 276.) Three hours.

278 Principles of Aquatic Systems. (See Natural Resources 278.) Three hours.

295, 296 Special Topics. Special topics or seminars in Geology beyond the scope of existing formal courses. Maximum of six hours toward graduate degree.

340 Petrology and Tectonics. Application of igneous and metamorphic petrology to problems in tectonophysics, including petrochemistry of the earth's crust and upper mantle and the internal structure of orogenic belts. *Prerequisite:* Permission of instructor. Three hours. Doolan, Hannah.

350 Paleogeography. Paleopositions of continents and the distribution of land areas and ocean basins through geologic time in the context of plate tectonics. *Prerequisite:* Permission of instructor. Three hours. Mehrtens.

360 Structural Analysis of Deformed Rocks. Mechanisms of rock deformation; fracture phenomena and analysis; fault zone characteristics; fold generation analysis. Stress and strain interpretation of deformational features in rocks and minerals. Field work. *Prerequisite:* 260 or equivalent. Four hours. Stanley.

361 Advanced Structural Geology. Selected topics in analytical structural geology. *Prerequisite:* 260 or equivalent. Three hours. Stanley.

371 Advanced Readings. Readings and research problems intended to contribute to the program of graduate students in areas of geology for which formal courses are not available. *Prerequisite:* Graduate standing in geology. One to three hours.

391 Master's Thesis Research. Credit as arranged.

German (GERM)

Professors Mieder (Chairperson), Scrase; Associate Professors Mahoney, Richel, Schreckenberger.

Current research interests include East German literature; history of the German language; medieval literature; literature of the 18th, 19th, and 20th centuries; and folklore.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF ARTS

An undergraduate major in German, including a year course in literature and a year course in advanced composition and conversation or the equivalent. Satisfactory scores on the Graduate Record Examinations general (aptitude) section.

MINIMUM DEGREE REQUIREMENTS

Thirty hours of graduate level courses including German 281, 282 or 295, 296; additional courses in German, which may include two advanced courses in a related field (six hours), thesis research (six to 12 hours).

The department also offers a program leading to the degree of Master of Arts in Teaching (see page 20). Satisfactory scores on the Graduate Record Examination general (aptitude) section are prerequisite to acceptance to candidacy for this degree.

COURSES OFFERED

201 Methods of Research and Bibliography. Introduction to tools and methods of research, including major bibliographical sources, reference works, dictionaries, editions, and journals concerned with German literature, language, and folklore. *Prerequisites:* Two 100 level courses or permission. Three hours. Mieder. Alternate years.

202 Expository Writing. Improvement of writing skills through work with authentic texts from different content areas (literature, media, science, business). Emphasis on stylistic development and sophisticated vocabulary-building. *Prerequisites:* Two 100 level courses or permission. Three hours. Mieder, Schreckenberger. Alternate years.

213 History of the German Language. Historical and linguistic development of the German language from Indo-European to the present, with emphasis on sound shifts, the 16th century, and the modern age. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Mieder. Alternate years.

214 Middle Ages. Analysis and discussion of several "Minnesang" poets (esp. Walther and Neidhart), the *Nibelungenlied*, the courtly epics *Erec*, *Parzival* and *Tristan*, and the satirical epic *Helmbrecht*. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Mieder. Alternate years.

225 Goethe. Study of Goethe's accomplishments in poetry, drama, and the novel during major phases of his literary career: "Sturm und Drang," Classicism, and Romanticism. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Mahoney, Richel. Alternate years.

226 Schiller. Major attention will be paid to Schiller's development as a dramatist (from *Die Räuber* to *Wilhelm Tell*) as well as to his contributions to German Classicism. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Mahoney, Richel. Alternate years.

237 19th-Century Prose. Literary and stylistic analysis of prose works by Tieck, Kleist, Stifter, Gotthelf, Droste-Hülshoff, Storm, Keller, and Hauptmann with emphasis on Romanticism, Poetic Realism, and Naturalism. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Mieder. Alternate years.

238 19th-Century Drama. Analysis of plays by Tieck, Kotzebue, Kleist, Büchner, Grillparzer, Nestroy, Hebbel, and Hauptmann. Consideration of traditional Viennese "Volkstheater" and the period's major literary movements. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Richel. Alternate years.

247 German Literature from 1890 to 1945. Naturalism, Symbolism, Expressionism and subsequent trends through readings of authors such as Hauptmann, Rilke, Kaiser, Kafka, Mann, and Brecht. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Schreckenberger, Scrase. Alternate years.

248 Contemporary German Literature. Literary movements and their major representatives from 1945 to the present, including relevant socio-political, intellectual, and cultural aspects. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Schreckenberger, Scrase. Alternate years.

251 German Folklore. Verbal folklore genres (fairy tales, legends, folk songs, and proverbs) treated in their relation to literature, mass media, and popular culture. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Mieder. Alternate years.

252 Faust. Focus on one of the major themes of world literature. Readings include the "Volksbuch" of 1587, and works by Marlowe, Goethe and Thomas Mann. *Prerequisites:*

155 or 156 and one other 100 level course or permission. Three hours. Richel. Alternate years.

263 German Romanticism. Study of major works by authors such as Friedrich Schlegel, Novalis, Brentano, Hoffmann, and Eichendorff in their literary, artistic, philosophical, and socio-political contexts. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Mahoney. Alternate years.

264 German Lyric Poetry. The lyric genre and the historical development of German poetry from the age of Goethe to the present. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Scrase. Alternate years.

271 Proverbs. Diachronic and synchronic survey of German proverbs, proverbial expressions, and wellerisms, emphasizing their use and function in literature, art, mass media, advertisements and oral communication. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Mieder. Alternate years.

273 German Intellectual Movements. A survey of developments in art, music, philosophy, and social thought from the Enlightenment to 1945, with particular attention to their impact on German literature. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Mahoney. Alternate years.

275 Fin-de-Siècle. Prevalent literary and intellectual movements at the turn of the 20th century in their historical, socio-political, and cultural contexts. Study of Nietzsche, Freud, Rilke, Hofmannsthal, Schnitzler, and Mann. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Schreckenberger. Alternate years.

276 Brecht and the Modern Drama. Brecht's revolutionary concept of "epic theatre" in theory and practice and its influence on subsequent dramatists, including Dürrenmatt, Frisch, Handke, Hochhuth, Müller, and Weiss. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Richel. Alternate years.

278 GDR Fiction. GDR fiction in its literary, historical, and social contexts, with reference to major developments in the GDR from 1949-89. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Scrase. Alternate years.

279 The German Short Story After 1945. Aesthetic and thematic evolution of the short story and its relation to historical, political, and cultural developments from 1945 to the present. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Schreckenberger. Alternate years.

281 Seminar on Literary Genre, Period, or Theme. Study of a literary genre, period, or theme through close readings of representative texts supplemented by lectures and reports on socio-cultural context. May be repeated. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Staff. Alternate years.

282 Seminar on a Particular Author or Authors. Study of author(s) through close readings of representative texts supplemented by lectures and reports on the works' socio-cultural context. May be repeated. *Prerequisites:* 155 or 156 and one other 100 level course or permission. Three hours. Staff. Alternate years.

295, 296 Advanced Special Topics. Advanced courses or seminars on topics beyond the scope of existing departmental offerings. See Schedule of Courses for specific titles.

391 Master's Thesis Research. Credit as arranged.

Historic Preservation (HP)

Chester H. Liebs, (Director); Professors Felt, Hand, Janson, Powers, Stout; Research Assistant Professor Visser; Distinguished Visiting Faculty Dawn Andrews, David Carris, Elsa Gilbertson, Holly Groschner, Curtis Johnson, Roger Lang, Samuel Stokes, Emily Wadhams, Elizabeth Watson.

An interdisciplinary graduate program leading to a Master of Science in Historic Preservation is offered by the History Department in partnership with the Department of Art, and with the cooperation of the Departments of Anthropology and Agricultural and Resource Economics, and the Environmental Studies Program. Enrollment is limited to a small number of qualified participants who are seeking an intensive, community-oriented educational experience which effects a balance between academic and professional training. As its underlying philosophy, the program recognizes the diverse contributions, both high-style and vernacular, that every generation has made to the built environment and views historic preservation as a form of management which keeps these contributions in balance. The program is designed to develop future leaders to help foster economic growth through the stewardship of historic resources and to provide a focus within northern New England for research on and public awareness of the region's outstanding built environment. The program sponsors an Historic Preservation Summer Institute. Through its Architectural Conservation and Education service, it also provides technical preservation and educational services on an contract basis. The program has been certified as meeting standards for professional training established by the National Council for Preservation Education.

Applicants desiring financial aid may be nominated for Graduate College Fellowships or for Graduate Teaching Fellowships in the History Department. The demands of the Historic Preservation program, however, usually preclude its students from holding Student Personnel Fellowships.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE IN HISTORIC PRESERVATION

(1) A baccalaureate degree with a major in a preservation-related field such as architecture, architectural history, history, planning, business administration, economics, engineering, interior design, law, or environmental studies. (2) Applicants must take the general (aptitude) portion of the Graduate Record Examination and submit a sample independent research paper, design project, or other evidence of preservation-related professional ability. Almost all successful applicants have spent at least a year in a preservation-related job or volunteer work after the baccalaureate.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

Admission to this highly competitive program constitutes acceptance to candidacy as well.

MINIMUM DEGREE REQUIREMENTS FOR THE MASTER OF SCIENCE

(1) Thirty-six credit hours of course work. A minimum of 24 credit hours (including an internship or thesis) must be taken in historic preservation. Participants are urged to choose electives that will fill in gaps in their previous training. (2) A comprehensive examination given during the third semester. (3) An internship in a preservation agency,

or a written thesis. This may be undertaken upon completion of two or three semesters of concentrated course work. At the conclusion of the internship, an oral presentation describing work accomplished will be given before a jury of practicing professionals for evaluation. (4) Historic Preservation 201, 203, 204, 205, 301, 302 and 303 or 304 are required courses for the degree. Students will also normally take History 351 (Proseminar in American Cultural History) and Art 207 (Seminar in American Architecture and Design) unless they have had sufficient backgrounds in these areas.

COURSES OFFERED

201 Architecture, Landscape, and History. An examination of methods for deciphering the underlying cultural and environmental forces that have shaped the nation's buildings, towns, cities, and rural landscapes. *Prerequisites:* An advanced course in one of the following areas: American History, Architectural History, Historical or Cultural Geography, Archeology, or by permission. Three hours. Andrews, Liebs.

202 Special Topics. Courses are offered yearly by visiting faculty under this number, in specialized areas of historic preservation, through Continuing Education.

203 Conservation Techniques for Historic Structures. Structural systems, materials found in historic resources; methods for conservation. Preservation of brick, stone, wood, plaster, metals, paints, etc. Introducing new systems into structures without violating historical integrity. Three hours. Visser.

204 Historic Preservation: Development Economics. Survey of economic, financial aspects of real estate development pertaining to preservation and adaptive use (market studies, proformas). Field trips. Actual proposal development for under-utilized historic properties. Three hours. Lang, Wadhams.

205 Historic Preservation Law. Legal issues in conservation of the built environment. Basic legal techniques for protection of historic structures (historic districts, protective legislation, easements, covenants). Study of significant court decisions. Three hours. Carris, Groshner.

301 Historic Preservation Contemporary Practice. Detailed study of current historic preservation practice through field trips, seminars with practicing professionals; technical training in architectural taxonomy, environmental impact review, funding solicitation, preservation agency administration. Six hours. Gilbertson, Johnson, Liebs, and distinguished visiting lecturers.

302 Community Preservation Project. Third-semester graduate students apply developed professionals skills to actual community preservation problems. Projects include strategy development, securing and allocating funds, research, advocacy, and implementation. *Prerequisites:* 301, graduate status in the Historic Preservation Program. Three hours. Liebs or staff.

303 Internship. Participants will devote a semester to preservation within an appropriate institution or agency. Three hours. Liebs, Stout.

307 Advanced Architectural Conservation. Advanced microscopic and macroscopic analysis of historic structures through site investigations, laboratory research, and seminars. *Prerequisite:* 203. Three hours. Visser.

391 Master's Thesis Research. Credit as arranged.

395 Special Topics. Credit as arranged.

397 Special Readings and Research. Credit as arranged.

History (HST)

Professors Andrea, Daniels (Emeritus), Davison (Emeritus), Felt, Hand, Hutton (Director of Graduate Studies), Liebs (Director, Historic Preservation Program), Metcalfe (Director, Canadian Studies Program), Overfield (Chairperson), Schmokel (Emeritus), Schultz (Emeritus), Seybolt, Spinner (Emeritus), Steffens, Stoler, Stout; Associate Professors McGovern, Rodgers, See, True; Assistant Professors Bergen, Saad, Youngblood; Adjunct Professors Feeney, Krueger; Visiting Assistant Professors A. Gustafson, Randall.

Research interests include American colonial, revolutionary, federal, 19th- and 20th-century eras as well as American cultural, intellectual, military, social, state and local history, and women's history and U.S. foreign relations; Medieval Europe; Renaissance and Reformation; histories of Canada, China, England (Tudor-Stuart and Georgian periods), France; modern Germany; social and cultural history of Russia and the Soviet Union; the modern Middle East and Islam; Mexico, Central America, and the Caribbean; history of music; history of science; ethnohistory; popular culture; historiography; material culture.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF ARTS AND MASTER OF ARTS IN TEACHING

Applicants should have an undergraduate major in history, or in a related field of the social sciences or humanities with the equivalent of a minor in history. They must take the Graduate Record Examination and submit with the application a sample of writing, such as a research paper done in the course of undergraduate study.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF ARTS

Each student's Studies Committee will certify admission to candidacy when it has approved a course of study (which may include remedial work such as courses in appropriate foreign languages) and a tentative thesis topic.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF ARTS IN TEACHING

See page 20.

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS

Twenty-four hours in History, including six hours in thesis research and six additional hours in History or a related field. The Comprehensive Examination, in which questions must be passed in at least two different historical areas, must be taken by the end of the third semester. Completion and successful oral defense of a thesis.

COURSES OFFERED

The specific subject matter of each seminar will vary according to the instructor's interests. Graduate work in seminars, however, generally consists of extensive reading in the secondary literature of the field and the application of that material in a major research paper.

201 Architecture, Landscape, and History. (Same as Historic Preservation 201.) Three hours. Liebs.

209, 210 Seminar in Global History. Selected topics on the nature and results of interactions among the world's peoples. History 209: to 1500, History 210: since 1500. *Prerequisites:* Permission, 12 hours of history. Three hours. Andrea, Overfield.

221, 222 Seminar in Ancient History. Selected aspects of Near Eastern, Greek, or Roman history (e.g. trade and colonization, imperialism, social and political institutions, cultural and intellectual developments). Three hours. Rodgers.

224 Seminar in Medieval Europe. Selected topics on Europe from the fall of Rome to the Renaissance. *Prerequisites:* Permission, 12 hours of history including 23 or 24. Three hours. Andrea.

225 Seminar in Early Modern Europe. Selected topics on European history from the Renaissance to the French Revolution. *Prerequisites:* Permission, 12 hours of history. Three hours. Metcalfe, Overfield, Steffens.

226, 227 Seminar in Modern Europe. Three hours. Hutton, Steffens.

228 Seminar on Popular Culture. History of the attitudes of ordinary people towards everyday life in European society from the Middle Ages to the present. *Prerequisites:* Permission, 12 hours of history. Three hours. Hutton.

235 Islamic History. In-depth study of Islam, focusing on ideas rather than events. Topics include law, Sufism, art, philosophy and resurgent Islam. *Prerequisite:* 135 or permission. Three hours. Saad.

236 Seminar in the Modern Middle East. Historical analysis of the major conflicts in the region, emphasizing the roles of nationalism, religion, foreign influences, and war. *Prerequisite:* 136 or permission. Three hours. Saad.

237 Seminar in Russian History before 1917. Selected topics in Russian intellectual, social, and cultural history focusing on the period 1825–1917. *Prerequisites:* Permission, 12 hours of history including 137. Three hours. Youngblood.

238 Seminar in Soviet History. Selected topics in Soviet social and cultural history from the Bolshevik Revolution to the death of Stalin (1917–53). *Prerequisites:* Permission, 12 hours of history including 137. Three hours. Youngblood.

250 Seminar in East Asian History. Topics in the history of East Asia. *Prerequisites:* Permission, 12 hours of history. Three hours. Seybolt.

252 Seminar on China. Selected topics in the history of China. *Prerequisites:* 12 hours of history including 150 or equivalent. Three hours. Seybolt.

261, 262 Seminar in Latin American History. Selected topics in Latin American History. 261: Early Latin America; 262: Modern Latin America. *Prerequisites:* Permission, 12 hours of history. Three hours. True.

265 Seminar in Canadian History. Topics in 19th and 20th-century Canadian history: national development, regionalism, multiculturalism, and international relations. Three hours. See.

271, 272 Seminar in United States Social History. Topics in United States Social History. 271: to the Civil War; 272: Civil War to the Present. *Prerequisites:* Permission, 12 hours of history. Three hours. Gustafson, McGovern.

273, 274 Seminar in Modern American History. Three hours. Felt, Hand, McGovern, Stoler.

277 Colonial Origins of American Society. How European patterns of life and systems of belief eroded in 17th and 18th century America and evolved into a distinctly American society. *Prerequisites:* Permission, 4 courses in the social sciences including at least 2 in history (25 and 177 recommended) and at least 1 from anthropology, economics, geography, religion, or sociology. Three hours. Stout

278 Colonial Origins of United States Government. Evolution of government (local to national levels) from English background through establishment of the U.S. Constitution, emphasizing political and constitutional aspects of the American Revolution. *Prerequisites:* Permission, 4 courses in the social sciences including at least 2 in history (at least 1 above 100, 177 or 277 recommended) and 1 political science. Three hours. Stout.

284 Seminar in Vermont History. Topical approach to Vermont history through original research utilizing primary sources available at UVM, the Vermont Historical Society, and the Vermont State Archives. *Prerequisites:* Permission, 184. Three hours. Hand.

285 Seminar in History of Science. Selected topics in the history of science. *Prerequisites:* Permission, 12 hours of history. Three hours. Steffens.

287 Seminar in Historiography. Topics and methods in contemporary historical writing. *Prerequisites:* Permission, 12 hours of history. Three hours. Hutton.

290 Historical Research and Computer Analysis. Role of computers and quantifiable research in broadening historical understanding. Practical computer skills lead to research projects using Vermont census material as a primary source. *Prerequisites:* Permission, 12 hours of history. Three hours. See.

291 Seminar in History and Film. Topics in the history of European cinema and society, focusing on the concepts of the filmmaker as historian and the film as historical artifact. *Prerequisites:* Will vary according to topic. Three hours. Youngblood.

292 Seminar in Comparative History. Three hours.

295, 296 Special Topics Seminar. Seminars on topics beyond the scope of existing departmental offerings. See Schedule of Courses for specific titles. *Prerequisites:* Permission, 12 hours of history. Three hours.

300 Graduate Tutorial. Readings and research in a specific area; topics to be individually arranged; attendance in appropriate undergraduate courses may be required (see undergraduate catalogue). *Prerequisite:* Permission of instructor. Variable credit. Staff.

301 Introduction to Graduate Study in History. Historical methods, philosophy of history, the history of history writing. Three hours. Stout.

351 Proseminar in American Cultural History. Intended primarily for students in Historic Preservation, but open to other graduate students. Three hours. Felt.

391 Master's Thesis Research. Required of all candidates for the M.A. Normally arranged for two semesters at three hours each.

397 Special Readings and Research. Directed individual study of areas not appropriately covered by existing courses. Variable credit.

Humanities (See page 103.)

International Studies (See page 103.)

Materials Science (Multidisciplinary)

Steering Committee Members: Director D. Durham (Mechanical Engineering); T. Flanagan (Chemistry); W. Varhue (Electrical Engineering; J.R. Wu (Physics). Faculty: Professors Allen, Anderson, Brown, Flanagan, Smith, Von Turkovich; Associate Professors Durham, Fuhr, Leenstra, Titcomb; Assistant Professors Ahmed, Keller, Rosenthal, Varhue and Wu.

Participating faculty are from the following departments: Computer Science and Electrical Engineering, Civil and Mechanical Engineering, Physics, and Chemistry.

The program in Materials Science is multidisciplinary. It is involved with the mechanical, electrical, chemical, and physical properties of materials — primarily solids — and applications of these materials. It is multidisciplinary in the sense that it combines the theoretical and experimental capabilities of a variety of disciplines and applies them to the solution of complex scientific and engineering problems. Problems such as corrosion, analysis and synthesis of electronic materials, development of bulk and thin film electronic devices and integrated circuits, optimization of mechanical properties of structural materials, and failure analysis are typical examples requiring such an interdisciplinary approach. The course program gives a broad background in materials. It also provides flexibility allowing specialization in particular areas of interest.

The program in Materials Science offers the Master of Science degree and the Doctor of Philosophy degree. Each student must meet the general requirements for admission as outlined under the Regulations of the Graduate College. Students in the program are sponsored by the participating department which best reflects the students' backgrounds and interests.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

A bachelor's degree in physics, chemistry, metallurgy, engineering, materials science, or mathematics. Applicants with other backgrounds will be evaluated individually.

MINIMUM DEGREE REQUIREMENTS

The above requirements for admission must be supplemented in either of the following ways:

Plan A: With Thesis: 30 graduate credit hours of an approved program of study including at least 18 credit hours of course work; completion of at least one three-credit hour course in each of the following categories; solid state theory, quantum mechanics, applied mathematics, and materials properties of solids; satisfactory completion of a comprehensive examination, and satisfactory completion of an M.S. thesis including its defense at an oral examination.

Plan B: Without Thesis: 30 credit hours of an approved program of study; completion of at least one three-credit hour course in each of the following categories: solid state theory, quantum mechanics, applied mathematics, and materials properties of solids, and satisfactory completion of a comprehensive examination.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

An accredited master's degree (or equivalent) in physics, chemistry, metallurgy, engineering, mathematics, or materials science.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Successful completion of a Ph.D. comprehensive examination in Materials Science and demonstrated competence in computer programming. The comprehensive examination includes the areas of quantum mechanics, solid state theory, applied mathematics, thermodynamics, and materials properties of solids.

MINIMUM DEGREE REQUIREMENTS

In addition to the above, the following are required:
A minimum of 75 graduate credit hours including a minimum of 20 in dissertation research. An overall grade-point average in graduate courses of 3.25 or better. Completion of at least one three-credit hour course in each of the following categories: solid state theory, quantum mechanics, applied mathematics, thermodynamics and kinetics, and one course in each of two categories dealing with materials properties of solids. Satisfactory completion of a Ph.D dissertation including its defense at an oral examination.

COURSES OFFERED

The program of Materials Science will offer a seminar course each semester (See Director or Advisor for appropriate details), as well as thesis or dissertation research. All other courses in a student's program are offered by the individual departments — primarily Chemistry, Electrical Engineering, Mathematics, Mechanical Engineering, Physics, and Statistics.

391 Master's Thesis Research. Credit as arranged.

491 Doctoral Dissertation Research. Credit as arranged.

Mathematics (MATH)

Professors Ashikaga, Chamberlain, Cooke, Costanza, Dinitz, Foote, Golden, Gross (Chair), Haugh, Lakin, Pinder, Wright; Research Professor Aleong; Associate Professors Archdeacon, Burgmeier, Dummit, Mickey, Oughstun, Sands, Son, Wilson, Zwick; Research Associate Professor McAuliffe; Assistant Professor Yu; Lecturers Brown, Johansson, Kost, Larson, Lawlor, MacPherson, Morency, Puterbaugh.

The Department of Mathematics offers programs towards the Master of Science, Master of Science in Teaching, Master of Arts in Teaching, and the Doctor of Philosophy in Mathematical Sciences. There are two areas of concentration: pure mathematics and applied mathematics. The programs emphasize the interaction between these two areas and the common role of scientific computation. First-year students take courses common to both areas, enabling them to gain an appreciation of the mathematical techniques and the connections between theory and applications.

Department research interests include classical analysis, harmonic analysis, Fourier analysis, approximation theory, algebra, number theory, graph theory, combinatorics, fluid mechanics, biomathematics, differential equations, numerical analysis, and modeling.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE AND DOCTOR OF PHILOSOPHY

Because of the breadth of pure and applied mathematics, it is recognized that applicants for admission will have diverse backgrounds. Admission requirements are therefore flexible. Applicants should have demonstrated strength in either pure or applied mathematics, a bachelor's degree with a major in mathematics or a closely related discipline, and satisfactory scores on both the general and subject (mathematics) sections of the Graduate Record Examination.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

Math. 241 and 242 or their equivalent; these courses will not count toward the degree requirements.

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

Each student must complete one of the following options:

a. Twenty-four semester hours of acceptable graduate credits in advanced mathematics course; six semester hours of thesis research culminating in a Master's thesis, or
b. Thirty semester hours of acceptable graduate credits in advanced mathematics courses; no thesis required.

Under either option students must take, or acquire knowledge of the content in, the following courses: Math. 251, 331, 333, and either 252 or 274. Students must satisfactorily complete at least four 300-level mathematics courses and the seminar 382. By approval of the student's advisor, up to six hours from an area of minor concentration may be used to fulfill the degree requirements.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Math. 241 and 242 or their equivalent; these courses will not count toward the degree requirements. Successful completion of three qualifying examinations, two written and one oral, in one of the areas of concentration.

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Each student must complete the three qualifying exams and an approved plan of study including at least 75 credit hours in course work or dissertation research. The student is required to write a doctoral dissertation and pass a final oral defense of that dissertation. The Department requires two semesters of college-teaching experience. Students are expected to demonstrate appropriate proficiency in the use of computers. There is no formal language requirement.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES AND ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE FOR TEACHERS

A bachelor's degree from an accredited institution and certification as a teacher of mathematics. Experience teaching secondary school mathematics. Satisfactory scores on the Graduate Record Examination.

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE FOR TEACHERS

Thirty hours of coursework in mathematics. With the approval of their advisor, students may choose courses from the 100-level or from closely related fields. The student must pass an oral comprehensive examination. No thesis is required.

REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN TEACHING

Thirty hours of coursework, including at least 21 in mathematics and six in education. With the approval of their advisor, students may choose courses from the 100-level or from closely related fields. The student must pass an oral comprehensive examination in mathematics and additional required examinations in education. No thesis is required.

COURSES OFFERED

207 Probability Theory. Same as Statistics 251.

221 Deterministic Models in Operations Research. The linear programming problem. Simplex algorithm, dual problem, sensitivity analysis, goal programming. Dynamic programming and network problems. *Prerequisites:* 124; 121 desirable or equivalent. Three hours.

222 Stochastic Models in Operations Research. Development and solution of some typical stochastic models. Markov chains, queueing problems, inventory models and dynamic programming under uncertainty. *Prerequisites:* 207 or Statistics 151, or permission of instructor. Three hours.

223 Introduction to Formal Language Theory. (Same as Computer Science 223.)

224 Analysis of Algorithms. (Same as Computer Science 224.)

230 Ordinary Differential Equations. Solutions of ordinary differential equations, the Laplace transformations, series solutions of differential equations. *Prerequisites:* 121, corequisite 124 or permission of instructor. Credit will not be granted for more than one of the courses 230 or 271. Three hours.

236 Calculus of Variations. Necessary conditions of Euler, Legendre, Weierstrass, and Jacobi for minimizing integrals. Sufficiency proofs. Variation and eigenvalue problems. Hamilton-Jacobi equations. *Prerequisite:* 230. Three hours. Alternate years.

237 Introduction to Numerical Analysis. Error analysis, root-finding, interpolation, least squares, quadrature, linear equations, numerical solution of ordinary differential equations. *Prerequisites:* 121, and 124 or 271, knowledge of computer programming. Three hours.

238 Numerical Differential Equations. Numerical solution of differential equations: initial-value and boundary-value problems; finite difference and finite element methods. *Prerequisites:* 237, either 230 or 271 recommended. Three hours.

240 Fourier Series and Integral Transforms. Fourier series, orthogonal functions, integral transforms, and boundary value problems. *Prerequisite:* 230 or 271. Three hours.

241 Real Analysis I. Properties of the real numbers, metric spaces, infinite sequences and series, continuity. *Prerequisites:* 121, 124, or equivalent. Three hours.

242 Real Analysis II. Differentiation in R^n, Riemann-Stieltjes integral, uniform convergence of functions, Inverse and Implicit Function Theorems. *Prerequisite:* 241. Three hours.

243 Introduction to Theoretical Computer Science. (Same as Computer Science 243.)

251 Abstract Algebra I. Basic theory of groups, rings, fields, homomorphisms, and isomorphisms. *Prerequisites:* 124 or permission of instructor. Three hours.

252 Abstract Algebra II. Modules, vector spaces, linear transformations, rational and Jordan canonical forms. Finite fields, field extensions, and Galois theory leading to the insolvability of quintic equations. *Prerequisite:* 251. Three hours.

255 Elementary Number Theory. Divisibility, prime numbers, Diophantine equations, congruence of numbers, and methods of solving congruences. *Prerequisite:* 102 or 104, or equivalent. Three hours.

257 Topics in Group Theory. Topics may include abstract group theory, representation theory, classical groups, Lie groups. *Prerequisite:* 251. Three hours. Alternate years.

260 Foundations of Geometry. Geometry as an axiomatic science; various non-Euclidean geometries; relationships existing between Euclidean plane geometry and other geometries; invariant properties. *Prerequisite:* 102 or 104, or equivalent. Three hours.

264 Vector Analysis. Gradient, curl and divergence, Green, Gauss and Stokes Theorems, applications to physics, tensor analysis. *Prerequisites:* 121, and 124 or 271, or equivalent. Three hours. Alternate years.

271 Applied Mathematics for Engineers and Scientists. Matrix theory, vector analysis, linear ordinary differential equations. Emphasis on methods of solution. No credit for mathematics majors. Credit will not be granted for more than one of 230 or 271. *Prerequisite:* 121 or equivalent. Three hours.

272 Applied Analysis. Partial differential equations of mathematical physics, calculus of variations, functions of a complex variable, Cauchy's Theorem, integral formula, conformal mapping. *Prerequisite:* 230 or 271. Three hours.

273 Combinatorial Graph Theory. Paths and trees, connectivity, Eulerian and Hamiltonian cycles, matchings, edge and vertex colorings, planar graphs, Euler's formula and the Four Color Theorem, networks. *Prerequisite:* 102 or 104 or equivalent. Three hours.

274 Numerical Linear Algebra. Direct and iterative methods for solving linear equations, least square factorization methods, eigenvalue computations, ill-conditioning and stability. *Prerequisite:* 237. Three hours.

275, 276 Advanced Engineering Analysis I, II. See Mechanical Engineering 304, 305. *Prerequisites:* Math 271 or Math 230; Math 275 for Math 276. Cross-listings: ME 304, 305; CE 304, 305.

295 Special Topics. Lectures, reports, and directed readings on advanced topics as announced. *Prerequisite:* Permission of instructor. Credit as arranged. Offered as occasion warrants.

325 Algebraic Theory of Automata. Use of algebraic methods to study automata and languages. Decomposition of machines and Krohn-Rhodes Theorem. Hierarchies of rational and context free languages. *Prerequisites:* 243, 251. Three hours.

330 Advanced Ordinary Differential Equations. Linear and nonlinear systems, approximate solutions, existence, uniqueness, dependence on initial conditions, stability, asymptotic behavior, singularities, self-adjoint problems. *Prerequisite:* 230. Three hours.

331 Theory of Functions of Complex Variables. Differentiation, integration, Cauchy-Riemann equations, infinite series, properties of analytic continuation, Laurent series, calculus of residues, contour integration, meromorphic functions, conformal mappings, Riemann surfaces. *Prerequisite:* 242. Four hours.

332 Approximation Theory. Interpolation and approximation by interpolation, uniform approximation in normed linear spaces, spline functions, orthogonal polynomials. Least square, and Chebychev approximations, rational functions. *Prerequisites:* 124, 237. Three hours.

333 Theory of Functions of Real Variables. The theory of Lebesgue integration, Lebesgue measure, sequences of functions, absolute continuity, properties of L^p–spaces. *Prerequisite:* 242. Four hours.

335, 336 Advanced Real Analysis. L^2–spaces, L^p–spaces; Hilbert, Banach spaces; linear functionals, linear operators; completely continuous operators (including symmetric); Fredholm alternative; Hilbert-Schmidt theory; unitary operators; Bochner's Theorem; Fourier-Plancherel, Watson transforms. *Prerequisites:* 333; 335 for 336. Three hours.

339 Partial Differential Equations. Classification of equations, linear equations, first order equations, second order elliptic, parabolic, and hyperbolic equations, uniqueness and existence of solutions. *Prerequisites:* 230, 242. Three hours.

342 Computability and Recursive Function Theory. (Same as Computer Science 342.)

353 Point-Set Topology. Topological spaces, closed and open sets, closure operators, separation axioms, continuity, connectedness, compactness, metrization, uniform spaces. *Prerequisite:* 241. Three hours.

354 Algebraic Topology. Homotopy, Seifert-van Kampen Theorem; simplicial, singular, and Cech homology. *Prerequisite:* 353. Three hours.

382 Seminar. Topical discussions with assigned reading. Required of M.S. degree candidates. One hour.

391 Master's Thesis Research. Credit as arranged.

395 Special Topics. Subject will vary from year to year. May be repeated for credit. *Prerequisite:* Consent of instructor. Three hours.

Mechanical Engineering (ME)

Professors Francis, Hermance, Hundal (Chairperson), Outwater, Pope, von Turkovich; Associate Professor Durham; Assistant Professors Chattopadhyay, Huston, Keller, Squires; Adjunct Professor Ferris-Prabhu.

Master of Science and Doctor of Philosophy programs are offered. Candidates holding degrees other than those in Mechanical Engineering are encouraged to apply. In such cases, it is normally necessary for students to complete the entrance qualifications without receiving credit toward their graduate studies. In all courses, general requirements for admission, as outlined under the Regulations of the Graduate College, must be met. Areas of research interest include biomechanics; combustion; computer-aided design, continuum mechanics; design methodology, fluids mechanics; heat transfer; manufacturing processes; mechanical and thermal processing of metals; physical and mechanical metallurgy; solidification; vibrations.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

An accredited bachelor's degree in Mechanical Engineering or its equivalent.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

One semester of satisfactory performance in graduate courses.

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

The above prerequisites for acceptance to candidacy must be supplemented in either of two ways.

Plan A: Completion of advanced courses in mechanical engineering; mathematics, other approved courses and six to nine hours of thesis research for a total of 30 hours.

Plan B: Completion of 30 credit hours of advanced courses in mechanical engineering, mathematics, and other approved courses in lieu of thesis.

Students should decide which option they intend to pursue at the beginning of their program. Part-time students normally use Plan B.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

An accredited master's degree in mechanical engineering or its equivalent.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Successful completion of the Ph.D. comprehensive written examinations.

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

The degree of Doctor of Philosophy requires of candidates a minimum of 75 credit hours to be earned in course and in dissertation research. At least 40 credit hours must be earned in courses and seminars and a minimum of 25 credit hours must be earned in dissertation research. Candidates must be able to comprehend the literature of their field in at least one foreign language provided it is required for their dissertation work. The requirements specified under "Policies of the Graduate College" must also be met.

COURSES OFFERED

203 Machinery Analysis and Synthesis. Kinematic and kinetic analysis of two and three dimensional machines; kinematic synthesis; electromechanical and servo mechanisms; application to robotic mechanisms. Three hours.

207 Biomechanics I. Introduction to the structure and mechanics of the musculoskeletal system. Application of mechanics to bone, tendon, ligaments and other biological materials. *Prerequisites:* Graduate standing in ME, or instructor's permission. Three hours.

208 Biomechanics II. Introduction to biomaterials and the mechanical behavior of bioviscoelastic fluids or solids. *Prerequisites:* 207 or instructor's permission. Three hours.

232 Micromanufacturing Technologies (3-0). Crystal processes; thin films; vacuum, chemical vapor deposition; integrated circuit materials, processes selection. Manufacture of semiconductors, printed circuit boards, microchips, wafers. Micromachining, microfilming; precision instruments. *Prerequisite:* 161 or equivalent. Three hours.

241 Combustion Processes. Combustion thermodynamics; chemical kinetics; laminar flames, premixed and diffusion; turbulent flames; ignition, explosion, and detonation; droplet combustion; flame spread; large scale fires; rocket combustion. Three hours.

243 Compressible Flow. Foundations of compressible flow; isentropic flow; normal shock waves; flow in ducts with friction and with heating or cooling; generalized solution of combined effects. *Prerequisites:* 143 and Math. 271 or equivalent. Three hours.

245 Advanced Heat Transfer. Transient heat conduction; integral methods; convection; formulation and solution; boiling, condensation; radiant heat exchange in enclosures and with emitting-absorbing gases, advanced view factors. *Prerequisite:* Permission of instructor. Three hours.

272 Mechanical Behavior of Materials. Elastic and plastic behavior of single crystals, polycrystals; dislocations; approximate plastic analysis; anisotropic materials; hardness; residual stress; brittle, transitional, ductile fractures; fatigue; damping; creep, surface phenomena. *Prerequisites:* 101, permission. Three hours.

273 Corrosion of Materials. Corrosion principles: electrochemical, environmental, and metallurgical aspects. Corrosion testing. Corrosion prevention. Seawater corrosion. Biological corrosion. Material selection. *Prerequisite:* 102 or equivalent. Three hours.

277 Composite Materials. Fibers, matrices. Unidirectional and short fiber composites. Analysis of orthotropic lamina. Analysis of laminated composites. Experimental characterization. *Prerequisite:* 102 or equivalent. Three hours.

281, 282 Seminar. Presentation and discussion of advanced mechanical engineering problems and current developments. One hour.

295 Special Topics. Special topics in recently developed technical areas. Three hours.

304, 305 Advanced Engineering Analysis I, II. Problems in analysis in engineering, including ordinary and partial differential equations, special functions, matrices, tensor analysis, variational calculus, complex variables, perturbation methods. *Prerequisites:* Math. 271 or Math. 230; ME 304 for ME 305. Three hours. Cross-listings: CE 304, 305; Math 275, 276.

320 Special Problems in Elasticity. Advanced topics in the theory of elasticity in which there is a particular student and staff interest. Three hours.

322 Special Problems in Dynamics. Advanced topics in dynamics in which there is a particular student and staff interest. Three hours.

323 Special Problems in Thermodynamics. Advanced topics in thermodynamics in which there is a particular student and staff interest. Three hours.

324 Special Problems in Heat Transfer. Advanced topics in heat transfer in which there is a particular student and staff interest. Three hours.

325 Special Problems in Materials. Advanced topics in behavior of materials in which there is a particular student and staff interest. Three hours.

330 Matrix Methods in Structural Dynamics. Matrices, eigenvalue problems, forced vibration, wave propagation. Three hours. Cross-listing: Civil Engineering 372.

332 Engineering Elasticity. Tensors, complex variable, variational methods. Four hours.

338 Advanced Dynamics. Application of Lagrange's equation, Hamilton's principle to mechanical systems. Systems with constraints. Matrix formulation of problems in kinematics, dynamics. Stability of linear, nonlinear systems. Three hours.

342 Advanced Combustion. Equations of reacting mixtures; modeling of steady and unsteady combustion, homogeneous/heterogeneous systems; ignition, explosions, detonations; combustion aerodynamics: turbulence, swirl, sprays. *Prerequisite:* 241 or equivalent. Three hours.

343 Advanced Fluid Dynamics. Stress in continuum; kinematics, dynamics; potential fields; Wing theory; Navier-Stokes equation; hydrodynamic stability; turbulence; laminar, turbulent boundary layer theory; transient flows; free laminar, turbulent flows; mixing. Four hours.

344 Advanced Engineering Thermodynamics. Microscopic thermodynamics; Maxwell-Boltzmann, Bose-Einstein, Fermi-Dirac statistics; kinetic theory of gases; transport properties, compressed gases, liquids, solid states; chemical systems; irreversible processes; fluctuations. Three hours.

345 Advanced Heat Transfer. Generalized equation of heat conduction; classical integral transforms, approximate solutions; thermal boundary layers; forced and free convection; condensation, boiling, ablative cooling; radiation, statistical theory; mass transfer. Three hours.

346 Advanced Gas Dynamics. Compressible flow in ducts; friction, heat transfer; shock waves; small perturbation theory; high speed flows; transonic, supersonic, hypersonic flows; methods of characteristics. Aerodynamic heating; rarified gas flows. Three hours.

371 Advanced Engineering Design Analysis and Synthesis I. Application of fundamental concepts, principles of advanced mathematics, physics, mechanics, electricity, thermodynamics, fluid dynamics, heat transfer, and decision-making processes to design, analysis, synthesis of complex engineering systems. Four hours.

372 Systems Engineering. Advanced course in systems engineering, reliability, maintainability, safety and human factors engineering. Case studies. *Prerequisites:* 371 or permission of instructor. Three hours.

391 Master's Thesis Research. Credit as arranged.

395 Advanced Special Topics. Advanced topics in recently developed technical areas. *Prerequisite:* Graduate standing only. Three hours.

491 Doctoral Dissertation Research. Credit as arranged.

The following courses are offered infrequently but may be taught where sufficient student interest is demonstrated.

251 Technology and Society Seminar. Three hours.

262 Thermal Systems. Three hours.

321 Special Problems in Fluid Mechanics. Three hours.

333 Stress Analysis (Theory and Experiment). Three hours.

336 Continuum Mechanics. Three hours.

Medical Technology (MEDT)

Associate Professors Howard, Lachapelle (Director), Reed, Sullivan; Assistant Professor Huot; Clinical Assistant Professor Russell (Chair).

The Department of Medical Technology offers a Master of Science degree providing an in-depth preparation in the fundamental sciences of clinical laboratory practice and related areas for professionals interested in research/development, education or the pursuit of further graduate opportunities. Students may concentrate in areas related to clinical chemistry, clinical microbiology, hematology, and immunology.

Opportunities for research include: quality control, streptococcus identification, coagulation enzymology, platelet immunology, or other projects offered in conjunction with various basic science and clinical departments in the College of Medicine and Medical Center Hospital of Vermont.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

Completion of an accredited baccalaureate program in medical technology or related field, national certification or equivalent and a minimum of one year's pertinent professional experience. GRE aptitude score is required.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

Satisfactory completion of a two semester, graduate-level course in Biochemistry (equivalent to Biochemistry 301-302).

MINIMUM DEGREE REQUIREMENTS

Thirty credits total consisting of at least the following: Medical Technology 381 (two credits), thesis research (six credits), biochemistry lecture (six credits), clinically related sciences (six credits) plus other approved courses. A noncredit teaching practicum in the undergraduate program of Medical Technology is required.

COURSES OFFERED

381 Special Topics Seminar. Presentation and discussion of current areas of importance to professionals in medical technology. Seminar emphasizes clinical pathophysiology, education, administration and research. Students, faculty and guests present topics of interest for analysis and discussion. One hour per semester. Staff.

391 Master's Thesis Research. Credits as arranged. Staff.

395 Advanced Topics in Medical Technology. Lecture, directed reading or laboratory experiences on advanced or contemporary topics not presently included in other course offerings. *Prerequisite:* Permission. One to three hours.

Merchandising, Consumer Studies and Design (MCSD)

(See page 103.)

Microbiology and Molecular Genetics (MMG)

Professors Fives-Taylor, T. Moehring, Novotny, Schaeffer, Wallace (Chairperson); Associate Professors Burke, Fishel, Kurjan, Sjogren; Assistant Professors Bateman, Gilmartin, Johnson, Pederson, Periasamy; Research Professor J. Moehring; Research Associate Professor Raper; Research Assistant Professors Kow, Melamede, Pratt; Lecturers Silverstein, Tessman.*

Research activities include: The enzymology and regulation of cellular DNA repair processes; development of novel DNA sequencing strategies; self-splicing mechanisms of RNA; structure and assembly of transcription complexes in yeast chromatin; cloning and regulation of yeast ras/rho homologs; cloning and regulation of schizophyllum mating type genes; molecular mechanisms of bacterial adhesion; DNA methylation-directed regulation of mammalian transcription; RNA polymerase II/DNA interactions in eukaryotic cells; genetic recombination in mammalian cells; mRNA processing in mammalian cells; initiation and control of the carcinogenic state; and replication of animal viruses and action of protein toxins in mammalian cells.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

One year of biological science; mathematics through elementary calculus; one year course in Physics (Physics 11 and 12 equivalent); chemistry including one year of inorganic chemistry and one year of organic chemistry (equivalent of Chemistry 1, 2, 141 and 142). A student may be admitted pending satisfactory completion of one or two of the above courses during the first semester(s) of graduate study. Satisfactory scores on the general aptitude portion of the Graduate Record Examination. Subject GRE tests are recommended but not mandatory.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

Applicants may be accepted concurrent with admission, or candidacy may be deferred pending a period of satisfactory graduate study at The University of Vermont. Acceptance to candidacy is granted only to those students who have met all undergraduate course prerequisites.

MINIMUM DEGREE REQUIREMENTS

Participation throughout residence in Thesis Research 391; approved selected courses offered in the Department of

Microbiology and Molecular Genetics; Biochemistry 301-302; successful completion of thesis. Twenty-four hours of course credits, 16 of which must be taken from courses offered by the Department of Microbiology and Molecular Genetics, and six hours of research credits are required.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

One year of biology; chemistry equivalent to Chemistry 1, 2, 121, 141 & 142; mathematics through calculus; one year course in physics (Physics 11 and 12 equivalent); additional courses required by the Department depending on the aims of the student. A student may be admitted pending satisfactory completion of one or two of the above courses during the first semester(s) of graduate study. Satisfactory scores on the general aptitude portion of the Graduate Record Examination. Subject GRE tests are recommended but not mandatory.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Completion of undergraduate course prerequisites; satisfactory performance on teaching assignments, the cumulative examination, and in MMG 390 Research Problem Conception and Solution.

MINIMUM DEGREE REQUIREMENTS

Dissertation Research 491; MMG 390 Research Problem Conception and Solution; Biochemistry 301-302; approved selected courses from programs in Microbiology and Molecular Genetics, Biochemistry, and other departments at the discretion of the Department and Studies Committee; teaching assignments as arranged by the Department; successful completion of dissertation. Students are expected to develop proficiency in the use of computer language and programming. Thirty hours of course credits, 20 of which must be taken from courses offered by the Department of Microbiology and Molecular Genetics, and 45 hours of research credits are required.

COMBINED MEDICAL COLLEGE AND GRADUATE COLLEGE DEGREE PROGRAMS

Qualified students, following acceptance into the medical college, may simultaneously enroll in the Graduate College for a Master of Science or Ph.D. degree program in Microbiology and Molecular Genetics. The program would be developed with concurrence of the Dean for Student Affairs in the College of Medicine.

COURSES OFFERED

201 Microbiology and Molecular Genetics Lab I: Molecular Cloning. An intensive one semester advanced laboratory course in which students will learn the fundamentals of recombinant DNA technology through the isolation and characterization of an eukaryotic gene. *Prerequisite:* 65 or 66, or equivalent. Three hours. Coordinator: Silverstein. (Will not be offered until Department occupies Stafford Hall.)

203 Microbiology and Molecular Genetics Lab II: Mammalian Cell and Molecular Biology. Students will analyze gene expression in mammalian tissue culture cell lines learning the basic principles and techniques of mammalian cell culture, basic animal virology as well as somatic cell and mammalian molecular genetics. *Prerequisite:* Biochemistry, Genetics and/or Cell and Molecular Biology courses and permission of coordinator. Four hours. Coordinator: T. Moehring. Alternate years, 1992–93.

211 Microbiology and Molecular Genetics II: Prokaryotic Genetics. The organization, replication, and expression of genes in prokaryotes. Focus on the genetics of *Escherichia coli* and its viruses. *Prerequisite:* Introductory Microbiology, Biochemistry, Genetics, and/or Cell and Molecular Biology courses. Three hours. Coordinator: Novotny. Fall semester.

212 Microbiology and Molecular Genetics III: Lower Eukaryotic Genetics with an Emphasis on Yeast. The use of lower eukaryotes, such as the yeasts *Saccharomyces cerevisiae* and *Schizosaccharomyces pombe,* as model genetic systems to answer questions of basic biological importance. *Prerequisite:* Introductory Microbiology, Biochemistry, Genetics and/or Cell and Molecular Biology, and permission of Coordinator. Three hours. Coordinator: Johnson. Alternate years, 1993–94.

220 Environmental Microbiology. The activities of microorganisms, primarily bacteria, in air, soil, and water. *Prerequisite:* A previous course in microbiology. Three hours and lab (one hour) as 221. Coordinator: Sjogren. Alternate years, 1993-94.

222 Clinical Microbiology. Comprehensive study of human pathogenic microorganisms and their disease states in the human. Collecting, handling specimens, pathogenic bacteriology, medical mycology, and virology. Laboratory sessions provide practical experience in handling and identifying these pathogens. *Prerequisite:* 65 or 66, or equivalent. Immunology recommended but not required. Four hours. Coordinator: Silverstein.

223 Immunology. Analysis of the immune response with respect to structure and function of immunoglobulins and the T cell receptor, tolerance, innate and adaptive immunity, the Major Histocompatibility Complex, hypersensitivity states, cancer, and AIDS. *Prerequisite:* Permission of Coordinator. Three hours. Coordinator: Silverstein. Alternate years, 1993–94.

225 Microbiology and Molecular Genetics IV: Interaction of Eukaryotic Viruses with Mammalian Cells. An in-depth analysis of eukaryotic virus-mammalian cell interactions with particular emphasis on mechanisms by which viruses modulate gene expression in infected cells. *Prerequisite:* 65 or 66, or equivalent. Three hours. Coordinator: Silverstein. Alternate years, 1992–93.

254 Microbiology and Molecular Genetics V: Macromolecular Processing by Prokaryotes, Yeast and Viruses. Cellular, replication, recombination, repair and transcription of DNA, and processing, transport and translation of RNA occur in macromolecular assemblies. Structure, formation and function of these nucleoprotein assemblies will be described using examples from prokaryotes, yeast, viruses, and mammalian cells in culture. *Prerequisite:* 211 or equivalent, and AGBI 201 or BIOC 301 and 302 or equivalent. Three hours. Coordinator: Pederson. Alternate years, 1992–93.

302 Medical Microbiology. Fundamentals of pathogenic microbiology emphasizing mechanisms of disease production and mechanisms of resistance to infection. The ecologic rather than taxonomic approach is stressed. Primarily for medical students. *Prerequisite:* Departmental permission. Four hours. Coordinator: Silverstein.

303 Special Problems in Microbiology and Molecular Genetics. Supervised investigations in microbiology and molecular genetics. Credit as arranged.

310 Current Topics in Microbiology and Molecular Genetics. Seminar to focus on specific issues at the forefront of current research in molecular genetics. Meetings will involve student presentation and discussion of research articles. *Prerequisite:* Permission of Coordinator. Two hours. Staff.

390 Microbiology and Molecular Genetics: Research Problem Conception and Solution. Designed to instruct students in the preparation and defense of an original re-

search proposal. Students will defend their grant by oral examination. *Prerequisite:* Permission of Coordinator. Two hours. Coordinator: Bateman.

391 Master's Thesis Research. Credit as arranged.

491 Doctoral Dissertation Research. Credit as arranged.

Music (See page 103.)

Natural Resources (NR)

The School of Natural Resources offers four master's degree programs: the Master of Science in Forestry, the Master of Science in Natural Resource Planning, the Master of Science in Water Resources, and the Master of Science in Wildlife and Fisheries Biology.

FORESTRY

Professors Bergdahl, DeHayes, Donnelly, Hannah, Reidel, Whitmore; Associate Professors Forcier, Newton, Wang; Research Assistant Professor Scherbatskoy; Lecturer Turner; Extension Associate Professors Bousquet, McEvoy.

The goal of this Master of Science Program is to provide graduate students with advanced training in forestry science and the opportunity to further their knowledge and proficiency in some specialized aspect of forestry. The faculty has research interests which span the broad areas of biometry, ecology, genetics, tree improvement, management, pathology, physiological ecology, policy and administration, remote sensing, and silviculture.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE (FORESTRY)

Undergraduate degree in forestry or in a discipline related to the intended specific field of study. Satisfactory scores on the general (aptitude) portion of the Graduate Record Examination.

MINIMUM DEGREE REQUIREMENTS

The Forestry degree has two options.

Plan A: (Thesis Option) Requires 15 to 24 credit hours of advanced forestry and related courses, a comprehensive examination, 6 to 15 hours of thesis research, and an oral defense of the thesis. A student's thesis research is often an integral part of ongoing research projects.

Plan B: (Project Option) Requires 30 to 33 credit hours of advanced forestry and related courses, a comprehensive examination, three to six hours for a project pertinent to the student's area of specialization, and an oral defense of the project. The project is typically a forest resources management plan, a major paper, or a series of papers.

NATURAL RESOURCE PLANNING

Professor Cassell, DeHayes, Manning; Associate Professors Forcier, Gilbert, Hirth, Hudspeth, King, Lindsay, McIntosh, Newton, Richardson, Schmidt, Wang; Extension Associate Professor Marek.

This interdisciplinary program prepares students for professional careers with public agencies and private organizations engaged in various aspects of environmental and natural resource planning and management. It provides theoretical and practical coursework and experiences for those seeking to be environmentally-sensitive, resource-based planners and managers (town planners, regional planners, environmental regulation officials) as well as those seeking a broad natural resource education in such areas as: ecology and applied ecology; environmental law, policy, and administration; environmental economics; environmental education and interpretation; recreation management and tourism; management information systems (especially GIS), environmental studies, resource conservation, and sustainable development. Integrated resource management involving interdisciplinary problem-solving teams is stressed in most courses.

Efforts of faculty in the School of Natural Resources with the above specialties are augmented by those of colleagues in related fields at UVM, including the Field Naturalist, Public Administration, and Historic Preservation programs and the Center for Rural Studies. The academic program is further enriched by visiting faculty made up of leading Vermont planning and resource managers.

The program focuses on several concepts: seeking synergism between ecological concerns and economic health, considering the capacity of the land to support appropriate development (designing with nature as opposed to stressing technological solutions for transforming nature to meet human needs), understanding the "sense of place", understanding human institutions and behavior, and technical implementation (with emphasis on Geographic Information Systems).

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE (NATURAL RESOURCE PLANNING)

Undergraduate degree in an appropriate field in the sciences, social services, or humanities/fine arts; satisfactory scores on the Graduate Record Examination, general aptitude section; and three letters of recommendation attesting to the candidate's academic potential for graduate work and motivation for pursuing this degree. Almost all successful applicants to this highly competitive program have had past experience in an environmental or natural resource-related job, internship, volunteer work, or international travel.

MINIMUM DEGREE REQUIREMENTS

The Natural Resource Planning program offers two options.

Plan A: (Thesis option) Requires at least 24 credit hours of course work in related fields, a comprehensive examination, six hours of thesis research, and an oral defense of the thesis.

Plan B: (Project option) Requires at least 30 credit hours of course work in related fields (including five hours of core courses and four distributive courses), a comprehensive examination, six credit hours of project research, and an oral defense of the project.

Irrespective of the plan chosen, students in the Natural Resource Planning Program usually are in residence for two years.

WATER RESOURCES

Professor Cassell; Associate Professors Donnelly, LaBar, McIntosh; Assistant Professor Levine.

The Master of Science in Water Resources program is designed to provide students with an advanced understanding of water quantity and quality in the natural environment and with the skills and methodologies to analyze and solve

technical problems concerning the effects of human activities on water quality and quantity. Current areas of research emphasis include ecotoxicology; integrating dynamic and spatial models; non-point source pollution; stream and lake ecology; systems approaches to water resource modeling; water quality modeling; and watershed processes.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE (WATER RESOURCES)

Undergraduate degree in an appropriate discipline and satisfactory scores on the Graduate Record Examination, general (aptitude) section.

MINIMUM DEGREE REQUIREMENTS

The Water Resources degree requires 15 to 24 credit hours of course work in water resources and related fields; a comprehensive examination, six to 15 credits of thesis research, and an oral thesis defense.

WILDLIFE AND FISHERIES BIOLOGY

Associate Professors Capen, Hirth, LaBar; Research Associate Professors Parrish, Watzin, Williams; Assistant Professor Levine.

The Master of Science program is designed to provide a vehicle for a wildlife or fisheries biologist to develop research abilities and pursue a specialized course of study. Current areas of research emphasis include applied avian ecology, behavioral ecology, big game management, nongame wildlife populations, and freshwater fisheries ecology.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE (WILDLIFE AND FISHERIES BIOLOGY)

Undergraduate degree in wildlife and fisheries biology or management or in the biological sciences. Satisfactory scores on the Graduate Record Examination, general (aptitude) section.

MINIMUM DEGREE REQUIREMENTS

The Wildlife and Fisheries Biology degree requires 15 to 24 credit hours of course work in wildlife and related fields, a comprehensive examination, six to 15 hours of thesis research, and an oral defense of the thesis. The Studies Committee may require additional undergraduate preparation without credit toward the degree in instances of perceived deficiency.

COURSES OFFERED

FORESTRY (FOR)

205 Mineral Nutrition of Plants. See Plant and Soil Science 205.

221 Forest Soils and Site Relations. Forest soils from an ecological perspective. Profile development, physical properties, roots, water relations, nutrient cycling, topographic factors, site quality, and the potential to produce biomass. *Prerequisites:* 120, Plant and Soil Science 161 and permission. Three hours. Hannah. Alternate years, 1992-93.

222 Advanced Silviculture. Scientific bases for selected silvicultural practices. *Prerequisite:* Permission of instructor. Three hours. Hannah. Alternate years, 1993-94.

229 Water Relations of Plants. Terminology and measurement of soil moisture. Absorption, transport, and transpiration by plants. Effects of water excesses and deficits. *Prerequisite:* Permission. Three hours. Donnelly and Botany staff. Alternate years, 1992-93.

231 Integrated Forest Protection. Integration of concepts of forest protection using a holistic ecological approach to forest pest management. Detection, population dynamics, evaluation, prediction, and pest management considerations. *Prerequisites:* 133, 134 or permission. Three hours. Bergdahl. Alternate years, 1993-94.

242 Advance Forest Biometry. Advanced principles of estimation, prediction, inventory, and evaluation of forest resources. Use of system analysis techniques in natural resource management. *Prerequisite:* NR 140 or permission of instructor. Three hours. Newton. Alternate years, 1993-94.

252 Non-residential Real Estate Appraisal. Real estate fundamentals and their application to non-residential properties. Case histories of forest appraisals. Real estate appraisal in the 21st century. Business ethics. *Prerequisite:* Six credit hours of economics. Two hours. (Associated one-hour project may be elected concurrently.) Armstrong.

254 Advanced Natural Resource Policy. Advanced seminar in natural resource policy, with emphasis on current issues in forest policy. *Prerequisites:* Graduate or advanced undergraduate standing: 251 or permission of instructor. Three hours. Reidel. Alternate years, 1992-93.

271 Forestry Operations Research. Operations research procedures in forest management. Microcomputer approaches to queuing applications, replacement, inventory, linear programming, and simulation. *Prerequisite:* Computer Science, Math. 19, a 100-level course in Natural Resources, or permission. Three hours.

272 Forest Resources Management. Application of mathematical programming, growth and yield forecasting, and economic analysis to the planning and organization of forests for multiple-use sustained yield production. *Prerequisites:* 123, 153 or permission. Four hours. Newton.

285 Advanced Special Topics. Advanced special topics courses or seminars in forestry beyond the scope of existing formal courses. *Prerequisites:* Graduate or advanced undergraduate standing and permission of instructor. Credit as arranged.

324 Advanced Forest Genetics. Discussion of the adaptive and physiological nature of genetic variation in forest trees. Analysis of procedures, results, and interpretations of selected forest genetics research. *Prerequisites:* Statistics 211; FOR 124 or equivalent and permission. Three hours. DeHayes. Alternate years, 1993-94.

382 Seminar in Research Planning. See Natural Resources 382. One hour.

385 Selected Problems in Forestry. Advanced readings, or a special investigation dealing with a topic beyond the scope of existing formal courses. *Prerequisites:* Graduate standing, permission of instructor. Credit as arranged.

391 Master's Thesis Research. Credit as arranged.

392 Master's Project Research. Credit as arranged.

NATURAL RESOURCES (NR)

220 Landscape Ecology. Study of pattern, process and dynamics in the landscape. Considers the role of landscape pattern in determining habitat quality and ecosystem function. *Prerequisites:* One biology, one ecology course, or equivalent. Two hours. Wang.

235 Legal Aspects of Planning and Zoning. Comparison of Vermont planning and zoning law with that of other states. Case studies in planning, zoning, and land use controls. *Prerequisite:* Permission. Three hours.

240 Wilderness and Wilderness Management. See Recreation Management 240. Three hours. Manning.

244 Quantitative Assessments of Natural Resources. Principles associated with inventorying selected natural resources. Survey of measurement and estimation techniques for land, timber, wildlife, fisheries, surface water, and recre-

ation. *Prerequisites:* One course in statistical methods, one 200-level natural resource course, permission of instructor. Three hours. Newton.

252 Visual Resource Planning and Management. Investigates the theories and principles of aesthetics related to landscape perception, and their applications to visual impact assessment and scenic resource planning. Three hours.

254 Advanced Natural Resource Policy. See Forestry 254. Three hours. Reidel.

262 International Problems in Natural Resource Management. Discussion of problems associated with the management of natural resources which have international implications. Topics may include deforestation, desertification, fisheries, wildlife, refuses, fuelwood, pollution. *Prerequisite:* Permission. Three hours. Newton.

270 Toxic and Hazardous Substances in Surface and Ground Water. The fate of toxic and hazardous pollutants, including trace elements and organics, in surface and ground water; effects on human health and aquatic biota. *Prerequisites:* Biology 1, Chemistry 3; or equivalent. Three hours. McIntosh. Cross-listing: Geology 270.

271 Effect of Human Activities on the Lake Champlain Ecosystem. Physical, chemical and biological characteristics of lakes. Effects of stresses, including nutrient enrichment and toxic substances, on lakes. Corrective measures; coupling of management and science. *Prerequisites:* One of the following: 102, 276, 278, ZOOL 236, or equivalent. Three hours. McIntosh. Cross-listing: Geology 271.

272 Assessing Environmental Impact. Application of knowledge of science, policy, social systems, and human behavior to assess impacts arising from use and management of natural resources. *Prerequisite:* Permission. Four hours.

275 Natural Resource Planning: Theory and Methods. Investigates theoretical development of natural resource planning. Studies planning methods appropriate to protection and use of scenic, recreational, forest, agriculture, and historic resources and ecologically sensitive areas. *Prerequisite:* Permission. Three hours. King.

276 Water Quality Analysis and Interpretation. Selected aspects of water chemistry and bioassay as related to surface and ground waters. Laboratory analysis of water quality parameters and data interpretation. *Prerequisites:* One course in calculus, chemistry, and statistics, or equivalent. Three hours. Cassell. Cross-listing: Geology 276.

278 Principles of Aquatic Systems. Study of physical, chemical, and biological principles as related to natural aquatic systems. Modelling dynamic behavior of aquatic systems using system simulation techniques. *Prerequisites:* Math. 19, Physics 11, and Chemistry 3 and 4 or equivalent. Three hours. (Two hours lecture and three hours laboratory per week.) Cassell. Cross-listing: Geology 278.

285 Advanced Special Topics in Natural Resource Planning. Advanced special topics in natural resource planning beyond the scope of existing formal courses. *Prerequisites:* Permission of instructor. Credit as arranged.

375 Natural Resource Planning: Laboratory. Experiential laboratory applying natural resource planning theory and methods to local or regional issues. Students conduct a planning exercise for a town or region. *Prerequisites:* To be taken concurrently with 275. One hour. King.

380 Seminars in Natural Resources. Presentation and discussion of advanced problems, research, and current topics in natural resources by faculty, graduate students, and outside guest speakers. *Prerequisites:* Permission. 0.5 hours/semester, maximum two hours. School of Natural Resources faculty (Chairman of Curriculum Committee).

382 Seminar in Research Planning. Discussions of the planning and activities associated with graduate student projects and research. *Prerequisite:* Permission. One hour. Forcier.

391 Master's Thesis Research. Credit as arranged.

392 Master's Project Research. Credit as arranged.

RECREATION MANAGEMENT (RM)

225 Economics of Outdoor Recreation and Tourism. A socioeconomics analysis of recreation and tourism as an industry. Emphasis on regional, state, and community impact. *Prerequisites:* Economics 11, 12 or Resource Economics 61 or equivalent. Three hours. Bevins, Gilbert.

235 Outdoor Recreation Planning. The planning of large wildland areas for outdoor recreation. Emphasis on the planning process relative to the leisure time use of natural resources. *Prerequisites:* Advanced undergraduate or graduate standing in Recreation Management or permission. Four hours. Lindsay.

240 Wilderness and Wilderness Management. History, philosophy, and management of wilderness, national parks, and related areas. *Prerequisite:* 235 or permission. Three hours. Manning.

255 Environmental Interpretation. Philosophy, principles, and techniques of communicating environmental values, natural history processes, and cultural features to visitors to recreational settings through the use of interpretive media. *Prerequisite:* 235 or permission. Four hours. Hudspeth.

WATER RESOURCES (WR)

391 Master's Thesis Research. Credit as arranged.

WILDLIFE AND FISHERIES BIOLOGY (WFB)

232 Ichthyology. Biology of fishes. Study of the structure and function of systems; behavior and ecology of modern fishes. *Prerequisites:* Zoology 104 or 219 or equivalent, WFB 161. Three hours. LaBar. Alternate years, 1992-93.

271 Wetlands Ecology and Marsh Management. Structure and dynamics of natural and manmade marsh systems, emphasis on applied ecology, freshwater habitats and their wildlife populations. *Prerequisites:* 174 or permission. Three hours. Levine.

272 Wetlands Ecology and Marsh Management Laboratory. Qualitative and quantitative assessment of marsh habitats and wildlife populations, emphasizing management of waterfowl and furbearers. Technical paper required. One weekend trip. *Prerequisites:* 150; previous or concurrent enrollment in 271. One hour.

273 Uplands Wildlife Ecology. Integration of ecological principles, wildlife biology, land use, and human dimensions in wildlife. Emphasis on development and maintenance of wildlife habitat, and population regulation of uplands species. *Prerequisites:* 150, 174 or equivalent.. Three hours. Hirth.

274 Uplands Wildlife Ecology Laboratory. Laboratory and field experience related to upland species and management of their habitat. Field project required. *Prerequisite:* Previous or concurrent enrollment in 273. One hour. Hirth.

275 Wildlife Behavior. Behavior and social organization of game and nongame species as they pertain to population management. *Prerequisites:* One year of biology, an ecology course, 74 or 174 recommended, or equivalent. Three hours. Hirth.

279 Marine Ecology. Structure and function of major marine communities, including open ocean, benthos, coral reefs, and estuaries. Emphasis on unique ecological insights gained in the marine environment. *Prerequisites:* Biology 1

and 2, an ecology course, or instructor permission. Three hours. Watzin.

285, 286 Advanced Special Topics. Credit variable.

387, 388 Graduate Special Problems. Advanced readings or special investigation dealing with a topic beyond the scope of existing formal courses or thesis research, culminating in an acceptable paper. *Prerequisite:* Permission of instructor. Credit as arranged.

391 Master's Thesis Research. Credit as arranged.

RECOMMENDED COURSES IN OTHER COLLEGES

AREC 208 Agricultural and Food Policy.

AREC 222 Natural Resources Evaluation.

AREC 234 Practicum in Rural Planning.

CE 230 Community Planning Techniques.

CE 231 Community Planning Analysis.

CE 232 Community Design.

GEOG 287 Spatial Analysis I.

SOC 205 Rural Communities in Modern Society.

SOC 207 Community Organization and Development.

Nursing (GRNU)

Professors McGrath (Chairperson), Winstead-Fry; Associate Professors Brown, Cohen, Dale, Deck, Hamel-Bissell; Assistant Professors Green-Hernandez, Johnson, Murray; Visiting Associate Professor Sample; Adjunct Associate Professor Nosek.

Current research interests in the department include: caring, oncology, aging and human sexuality, empowerment, international perspective of grieving women, educational evaluation, chronic illness, health promotion, workload indexing, determinants of leadership, suicide, stress, women's health, determinants of health care of the elderly, and school health.

The Master of Science in nursing prepares professional nurses to assume leadership roles within the discipline of nursing in a variety of settings, to expand knowledge of nursing, develop expertise in a specialized area of nursing and acquire the foundation for doctoral study and continued professional development. Clinical tracks are offered in the following areas:

Adult health nursing
Community health nursing

Within the above areas three functional role options are available in:

Advanced clinical practice
Nursing administration
Nursing education

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

A bachelor's degree with a major in nursing, perferably with a grade point average of 3.00 or better. Eligible for licensure as a registered nurse in Vermont. Satisfactory scores on the Graduate Record Exam. Three letters of recommendation from persons who can assess your potential for graduate work. RN's with a bachelor's degree in another field may be admitted upon successful completion of the Bridge Process (a means to assess prior nursing knowledge).

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

Under most circumstances, meeting the requirements for admission as stated above will allow advancement to candidacy. Students who appear to be marginal in meeting admission requirements may be required to complete satisfactorily certain courses before acceptance as a degree candidate.

MINIMUM DEGREE REQUIREMENTS

Thesis Option
Completion of 36 hours of graduate courses in nursing and other approved courses. Additional six hours for thesis research.

Nonthesis Option
Completion of 36 hours of graduate courses in nursing and other approved courses. Additional three hours to develop a project relevant to advanced nursing.

Comprehensive Examinations

A written comprehensive examination is required. The examination will include content of the core courses.

COURSES OFFERED

296, 396 Special Topics in Graduate Nursing. Topics of interest to graduate nursing which are based on theory, research or advanced practice. Course content will deal with topics beyond the scope of existing formal courses or thesis research. *Prerequisite:* Permission of instructor. One to six hours.

300 Nursing Research – Application of Quantitative Methods. Study of philosophical assumptions, purposes and methods of quantitative research. Study of statistics and use of quantitative research in nursing. Knowledge and skills related to the research process are applied to delineate a nursing problem and to develop a plan for its study. *Prerequisite:* Permission of instructor. Three hours.

305 Pathophysiological Phenomena in Nursing Practice. Human response to environmental changes, compensatory mechanisms, aging, and their relationship to disease. Focus on physiology is related to planning and management of nursing care. *Prerequisite:* Permission of instructor. Three hours.

310 Nursing Theory. Exploration of the concepts, conceptual frameworks, and theories in nursing. Analysis of the current nursing theories with emphasis on the relationship between theory and practice. *Prerequisite:* Permission of instructor. Three hours.

315 Nursing Issues and Health Care Trends. Issues germane to contemporary nursing are explored. Forces influencing health care organizations are discussed with respect to concepts of management, leadership, change and nursing roles. *Prerequisite:* Permission of instructor. Three hours.

320 Nursing Research: Application of Qualitative Methods. Study of purposes, methods, and strategies underlying historical and philosophical principles, and the implementation of qualitative research in nursing. *Prerequisite:* Permission of instructor. Three hours.

330 Theory and Practicum in Adult Health Nursing I. Examination of concepts and theories essential to the assessment, diagnosis and clinical decision-making in adult health nursing. Class and clinical placement. *Prerequisites or Corequisite:* 300, 305 and 310. Four hours. Alternate years, Fall 1992 and 1994.

331 Theory and Practicum in Adult Health Nursing II. Analysis and evaluation of nursing concepts based upon theories, research and the practice of adult health nursing. Class and clinical placement. *Prerequisite:* 330. *Corequisite:* 315 and 320. Five hours. Alternate years, Spring 1993 and 1995.

332 Theory and Practicum in Adult Health Nursing III. Application and synthesis of concepts relevant to advanced practice in adult health nursing, with emphasis on role development. Class and clinical placement. *Prerequisites:* 331 and one elective. Six hours. Alternate years, Fall 1993 and 1995.

340 Theory and Practicum in Community-Health Nursing I. Examination of both nursing and non-nursing theories and models for the assessment of health needs and risk factors of populations with an emphasis on rural communities. Class and clinical placement. *Prerequisites or Corequisites:* 300, 305 and 310. Four hours. Alternate years, Fall 1992 and 1994.

341 Theory and Practicum in Community Health Nursing II. Examination of advanced practice roles in community health nursing related to the analysis of health promotion strategies and proposed strategies for change in the health of rural populations. Class and clinical placement. *Prerequisite:* 340. *Corequisites:* 315 and 320. Five hours. Alternate years, Spring 1993 and 1995.

342 Theory and Practicum in Community Health Nursing III. Synthesis and application of concepts, relevant to advanced practice roles in community health nursing with an emphasis in levels of prevention in rural communities. Class and clinical placement. *Prerequisites:* 341, one elective. Six hours. Alternate years, Fall 1993 and 1995.

362 Theory and Practicum in Nursing Administration. Theory and experience in the management of health care systems. Lectures and field experience. *Prerequisite:* One elective; 331 or 341. Six hours. Alternate years, Fall 1993 and 1995.

372 Theory and Practicum *in* Nursing Education. Development, implementation, and evaluation of curriculum in undergraduate, collegiate and nursing service education. Directed practice teaching included in area of clinical interest. *Prerequisites:* One elective; 331 or 341. Six hours. Alternate years, Fall 1993 and 1995.

390 Master's Project. Self-designed clinical paper or innovative production pertinent to advanced nursing practice. *Prerequisites:* 331 or 341 and permission of Academic Advisor. Three hours.

391 Master's Thesis Research. *Prerequisites:* 331 or 341 and approval of Studies Committee. Six hours.

395 Independent Study in Graduate Nursing. Individual work in graduate nursing with a base of theory, research or advanced practice. Student in consultation with faculty sponsor devises objectives, plan of work and evaluation for designated credit hours. *Prerequisites:* Permission of academic advisor and sponsoring faculty. One to six hours as arranged. Graduate Nursing Faculty as selected by student.

Nutritional Sciences (NUSC)

Professor Carew; Associate Professors Pintauro, Ross, Tyzbir (Chairperson); Assistant Professors Johnson, McArthur; Extension Assistant Professor Harvey; Research Associate Professor Poehlman; Lecturers Janson, Kanfer, Knisley.

The department mission is to study the relationship between nutrition, health and fitness (preventive nutrition) and between diet and disease (therapeutic nutrition). Faculty research encompasses both basic and applied or community aspects of human nutrition. Research is being conducted on: diet induced hormone mediated changes in metabolism during weight loss and regain; developing behavior modification programs to improve individual eating behaviors and the nutritional status, health and fitness of communities; factors effecting the nutritional status of children and disabled athletes; the relationship between diet and colon cancer and between dietary fiber, cholesterol metabolism and atherosclerosis; physiological factors effecting energy intake and expenditure in aging humans.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

An undergraduate major in nutrition or a science-related field. Satisfactory scores on the Graduate Record Examination, general (aptitude) portion.

MINIMUM DEGREE REQUIREMENTS

Thirty hours including thesis research (six to 15 hours). Twenty-one hours should be earned in the field of specialization; nine hours may be selected from related areas; courses in statistics, research methods and seminar are required.

COURSES OFFERED

Prerequisites for all courses: as listed, or equivalent, or by permission of instructor.

235 Recent Advances in Foods and Nutrition. Interpretation and application of particular topics and trends in foods and nutrition as evidenced through literature and research. May be taken more than once for a maximum of nine hours. *Prerequisites:* 43, chemistry, physiology, permission of instructor. Three hours.

237 Food Safety and Regulation. Comprehensive study of the relationships between food processing and preservation, food toxicology, and the scope, applicability, and limitations of U.S. food laws. *Prerequisites:* A course in Biochemistry. Three hours. Pintauro. Spring.

238 Food Service Systems Management. Organization and administration of food service systems including principles of production, accounting management decisions, communications, and legal responsibilities, specific to quantity food production. Emphasis on problem solving. *Prerequisites:* 138, Business Administration 120. Three hours. Janson. Spring.

240 Methods in Nutrition Education. Needs assessment, planning, and presenting of appropriate methods and materials for an identified audience in a community, school, or institutional setting emphasizing interpersonal communication, interviewing, and group process skills. *Prerequisites:* 43 and Speech 11. Three hours. Knisley. Spring.

241 Nutrition and Aging. Study of physiologic, psychologic, sociologic, and economic factors which influence nutrient requirements, nutritional status, and food habits of older people. *Prerequisite:* 144. Three hours. Poehlman. Spring.

242 Advanced Nutrition. Study of nutrients and their specific functions in metabolic process integrating cellular physiology, biochemistry, and nutrition. *Prerequisites:* Three hours in nutrition, a course in biochemistry and physiology. Three hours. Tyzbir. Spring.

245 Nutritional Biochemistry. Comprehensive study of metabolism of carbohydrates, lipids, and protein emphasizing hormonal control, nutritional and metabolic interrelationships, and dietary abnormalities (e.g. starvation and obesity). *Prerequisites:* 242. Three hours. Tyzbir. Fall.

246 Diet and Disease. Examination of the physiologic,

biochemical, and psychosocial basis of several disease states with application of the normal and therapeutic food and nutrition principles associated with treatment. *Prerequisites:* 37, 144, 240, 242. Four hours. Ross. Fall.

248 Community Nutrition. Analysis of current programmatic and policy approaches addressing the major nutrition-related health problems in the U.S. Emphasis on program planning, marketing, and evaluation of community nutrition services. *Prerequisite:* 246. Three hours. Johnson. Spring.

249 Nutrition Seminar. Literature review of recent developments in nutrition research. *Prerequisite:* 242. One hour. Tyzbir. Fall and Spring.

290 Research Methods in Nutritional Sciences. Advanced research methods, including grant preparation, Institutional Review Board requirements, data analysis and presentation, and selected techniques in advanced nutritional biochemistry. *Prerequisites:* Biochemistry with a laboratory. Four hours. Pintauro. Spring.

295 Special Topics. Lectures, laboratories, readings, or projects relating to contemporary areas of study. Enrollment may be more than once, maximum of 12 hours in 195 and 295 combined. Graduate students are limited to six hours in 295. *Prerequisite:* Departmental permission.

296 Field Experience. Professionally-oriented field experience under joint supervision of faculty and business or community representative. Hours arranged; maximum up to 15 hours in 196 and 296 combined. *Prerequisite:* Departmental permission.

307 Advanced Concepts in Nutrition. Study of biochemistry and physiology of digestion, absorption, and metabolism of nutrients. Methods of estimating and meeting dietary requirements for maintenance, growth, and reproduction of several species. *Prerequisite:* One of the following: 242 or a 200-level course in biochemistry. Three hours. Alternate years.

391 Master's Thesis Research. Credit as arranged.

Obstetrics and Gynecology

(See page 104.)

Orthopaedic Surgery (See page 104.)

Pathology (PATH)

Professors Craighead, Howard, Mossman, Stark, Trainer (Interim Chairperson), Winn; Associate Professors Bovill, Hardin, Heintz, Huber, Lee, Leslie, Macara, MacPherson, Morrow, Pendlebury, Tindle; Assistant Professors Allen, Anderson, B. Durand, D. Durand, Jessen, Taatjes, Tracy, Tutschka, Van Houten, Waters, Weaver; Research Associate Professor Smith.

Research interests are in the fields of anatomic, clinical, and experimental pathology. Current studies include histochemistry, connective tissue pathology and biochemistry, electron microscopy, neoplasia, teratology, immunopathology, virology, and lung diseases.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCENCE

Satisfactory undergraduate or graduate course work in chemistry and the biological sciences. Microbiology and immunology are also recommended but not required. Satisfactory scores on the Graduate Record Examination, general (aptitude) section. Persons interested in a Ph.D. program may wish to consider the interdisciplinary program in Cell and Molecular Biology in which Pathology participates.

MINIMUM DEGREE REQUIREMENTS

Anatomy 311 (three hours), Pathology 305 (three hours), Biochemistry 301–302 (six hours); additional approved courses; thesis research (six to 15 hours).

COURSES OFFERED

301 General Pathology. A study of the processes of injury, repair, neoplasia, degeneration, etc., as they affect cells, tissues, and the human patient. For medical students. *Prerequisite:* Departmental permission. Three hours.

302 Systemic Pathology. Introduction to diseases, pathologic processes with particular reference to their effects on various organ systems. Instruction in clinical laboratory medicine is correlated with work in systemic pathology. *Prerequisites:* 301, departmental permission. Eight hours.

305 Pathobiology of Disease. Basic state-of-the-art survey of pathobiological mechanisms for graduate and postdoctoral students who are not candidates for M.D. degree, advanced medical students, and pathology residents. *Prerequisites:* Required: basic background in chemistry including biochemistry. Desirable: microbiology including fundamental immunology, physiology. Three hours. Alternate year course with Immunopathology 395.

306 Pathobiology Laboratory. Basic histopathological features of fundamental disease processes. *Prerequisite:* Concurrent enrollment in 305. One hour.

375 Special Topics in Molecular Pathobiology. Three independent, rotating 1-semester modules concerning coronary heart disease (Fall), DNA replication (Spring) and DNA repair (Fall). Based on critical review of primary literature. *Prerequisites:* Biochemistry 301, 302. Three hours. Macara.

391 Master's Thesis Research. Investigation of a research topic under the direction of an assigned staff member, culminating in an acceptable thesis. Credit as arranged.

395 Special Topics in Pathology: Immunopathology. An in-depth analysis is planned into the role of the immune system in disease processes. Discussions center on current and controversial areas of immunopathology. *Prerequisites:* Immunology (Microbiology and Molecular Genetics 223) and 305 desirable, or departmental permission. Two hours. Alternate year course with 305.

Pharmacology (PHRM)

Professors J. Bevan (Chairperson), R. Bevan, Hacker, McCormack, Nelson, Scollins, Tritton; Associate Professors Brayden, Reit, Roberts, Shreeve; Research Assistant Professors Bhushan, Bigelow, Laher.

Research interests of the staff include: pharmacokinetics and pharmacodynamics of anti-AIDS and anticancer drugs; role of membranes in drug action; synthesis, properties and structure-activity relationships of biologically active nitrogen heterocyclic compounds; molecular biological approaches to the development of chemotherapeutic agents; mechanisms of drug resistance; effects of drugs on cellular ionic regulation; pharmacological properties of ion channels; receptor biology and pharmacology; regulation of cardiovascular function; pharmacological and structural differences in blood vessels; growth and development of the vasculature; neurohumoral synaptic transmission and microcirculatory regulation; derangements of vascular

properties in disease states such as hypertension, diabetes, and stroke; the importance of studying human blood vessels; vasoactive peptides and their role in circulatory control.

A pre- and postdoctoral training program in clinical pharmacology of anticancer drugs is offered in cooperation with the Vermont Cancer Center.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREES OF MASTER OF SCIENCE AND DOCTOR OF PHILOSOPHY

Year courses in biology, organic chemistry, physics, analytic geometry and calculus; physical chemistry and/or a reading knowledge of one foreign language may be additional prerequisites, depending on the requirements of the research supervisor; acceptable scores on the general (verbal, quantitative) and subject (advanced) sections of the Graduate Record Examination.

MINIMUM REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE

Pharmacology 301, 302, 303, 381, 391; supporting courses in biochemistry and physiology.

MINIMUM REQUIREMENTS FOR THE DOCTOR OF PHILOSOPHY DEGREE

Physiology and Biophysics 301; Biochemistry 301, 302; Pharmacology 301, 302, 303, 328, 381, 491; Biometrics and Applied Statistics 308.

COURSES OFFERED

272 Toxicology. The biology of environmental intoxicants and of drug abuse. Ecologic and physiologic consequences of the dissemination of agricultural, industrial, and medicinal chemicals. *Prerequisites:* Organic chemistry and background in biology. Three hours. Hacker.

290 Topics in Molecular and Cellular Pharmacology. Focus on basic principles, drug interactions with receptors, membranes, synapses, neurotransmitters, macromoles, cytoskeleton, ion channels and pumps, and mechanisms of drug resistance. *Prerequisites:* Organic chemistry, biochemistry, biology. Three hours. Staff.

301 Medical Pharmacology. The chemical and biological properties of drugs. *Prerequisite:* Departmental permission. Six hours. Staff.

302, 303 Pharmacological Techniques. Experiments conducted under supervision in the areas of drug metabolism, modes of drug action, physiochemical properties of drugs, bioassay, and toxicology. *Prerequisite:* Departmental permission. Two hours, by arrangement. Staff.

328 Introduction to Medicinal Chemistry. Important classes of drugs are surveyed. Emphasis is placed on relationships between physicochemical properties and pharmacologic activity; synthetic aspects are considered. *Prerequisite:* Chemistry 131-132, or permission of instructor. Three hours. McCormack.

372 Special Topics. Topics of current interest and importance in pharmacology are considered in depth through presentations by staff, students, and visiting scientists. *Prerequisite:* Departmental permission. Credit variable, one to three hours. Staff.

373 Readings in Pharmacology. Intensive directed reading in one area of pharmacology. Pharmacology students must choose a topic outside thesis research area. Term paper and seminar on selected topic required. *Prerequisite:* Departmental permission. Two hours, by arrangement. Staff.

381 Seminar. Current developments in pharmacology are presented for discussion by students. *Prerequisite:* Departmental permission. One hour. Staff.

391 Master's Thesis Research. Credit as arranged.

491 Doctoral Dissertation Research. Credit as arranged.

Philosophy (See page 104.)

Physics (PHYS)

Professors Arms, Brown, Detenbeck, Nyborg, Rankin, Scarfone, Smith (Chairperson); Associate Professors Sachs, Spartalian; Assistant Professor Wu.

The Department of Physics offers research opportunities in astrophysics, biophysics, solid state physics, and the physics of materials.

Astrophysical research centers on experimental radio astronomy, with particular emphasis on pulsars and the interstellar medium. Observations are carried out using major instruments of the U.S. National Observatories and generally involve computer analysis and interpretation.

Experimental and theoretical biophysics research projects include applications of Mössbauer spectroscopy to molecules of biological interest, quasielastic light scattering from motile microorganisms, and biophysical and medical ultrasound. Mössbauer studies are concerned with the electronic structure at the active site of iron-containing proteins and enzymes. Research in biophysical ultrasound is directed toward an understanding of the physical principles involved when ultrasound interacts with living systems. The scattering of highly coherent laser light is applied to measurements of the motility of single-cell organisms.

Theoretical and computational research programs in condensed matter physics deal with electronic, optical, lattice- dynamical, thermodynamic, electrical, and magnetic prop-erties of metals and alloys. Some of the general approaches include the analytical and numerical methods of self-consistent band theory, multiple-scattering theory, Green's function formalism, and density-functional theory.

One materials research project involves computation of the thermal response of composite material structures under the action of intense laser radiation, including the temperature dependence of thermal and optical properties, interference effects, and phase transitions to liquid, vapor, and plasma states.

Theoretical studies of the optical properties of materials include the electronic structure of defect complexes in ionic crystals, the application of subtracted dispersion relations to optical data analysis, and the separation of inter-and intra-band effects in the infrared spectra of metals. Related studies are concerned with theories of X-ray scattering, of X-ray optical properties, and of X-ray optical elements.

Several faculty members perform experiments on the nonlinear interactions of ultrasound with condensed matter. Other faculty members are active in the history and philosophy of physical science, with particular regard to the way in which it evolves, and applications to physics education. Particular interests include the relations between science, society, and technology issues in the physical sciences.

Opportunities for collaborative research with other University departments and groups include those with Chemistry, the Materials Science Program, Physiology and Biophysics, the Cell and Molecular Biology Program, Computer Science and Electrical Engineering, Civil and Mechanical Engineering, Medical Radiology, and Geology.

The Department participates in two doctoral programs: Materials Science and Cell and Molecular Biology.

Laboratory facilities are supplemented by computational facilities which include a campus-wide network on which a DEC 8600 VAX-cluster and an IBM 4381 are available. The Department itself houses a Micro VAX-11, PC's in variety, and several PDP-11's. Some of these control experiments; many have graphic outputs.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

Undergraduate majors in science, engineering, or mathematics are considered for admission to the program. Satisfactory scores on the Graduate Record Examination (general and subject section) are required.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

Physics 211, 213, and 273; two additional semester courses in physics above the sophomore level; two semester courses in mathematics above the sophomore level.

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

A total of 30 credit hours including a minimum of six hours of thesis research and at least nine hours of Physics courses numbered over 300.

The Department also offers programs leading to the degrees of Master of Science in Engineering Physics, Master of Arts in Teaching, and Master of Science for Teachers of Physical Science. As a participant in the Materials Science program, the Department sponsors candidates for the degrees of Master of Science and Doctor of Philosophy in Materials Science. Details are available elsewhere in the catalogue and also from the Physics Department.

COURSES OFFERED

201, 202 Experimental Physics. Experiments in classical and modern physics. Each student selects laboratory experiments appropriate to his/her background and interests. *Prerequisites:* 42, 22 or 128, Math. 121; or equivalent. Three hours per semester, four semesters maximum.

211 Mechanics. Newtonian dynamics of particles and systems of particles, with applications to problems of special importance, such as driven and coupled harmonic oscillators and central field trajectories. *Prerequisites:* 42, 22; Math. 121 or equivalent. Three hours.

213 Electricity and Magnetism. Fundamental principles of electricity and magnetism; electrostatic fields, and magnetic fields of steady currents. Electric and magnetic properties of matter and electromagnetic energy relationships. *Prerequisites:* 42, 22 or 125; Math. 121 or equivalent. Three hours.

214 Electromagnetism. An introduction to time-dependent electromagnetic fields. Maxwell's equations in space and matter. Electromagnetic waves and radiation. *Prerequisite:* 213. Three hours. Alternate years.

222 Advanced Biological Physics. Sound and electromagnetic waves, the latter including light, microwaves and X-rays; ionizing particles and radiation. Interaction of these physical agents with biological systems. *Prerequisites:* Chemistry 2; Math. 121 or 123; experience in applying differential equations. Departmental permission required. Four hours.

242 Introduction to Solid State Physics. Introduction to crystal structures, reciprocal lattices, lattice vibrations. Thermal properties of solids and free electron theory of metals and semiconductors. Elementary band theory. *Prerequisite:* 128 or equivalent. Three hours. Alternate years.

254 Atomic and Nuclear Physics. Phenomenological study of electronic structure of atoms, including vector model and various coupling modes. Development of quantum theory. Structure of the nucleus and properties of elementary particles. *Prerequisite:* 211. Three hours.

255 Physical Optics. An introduction to physical optics including polarization, birefringence, dichroism, scattering, and diffraction of light. Fourier transform analysis of optical images. *Prerequisites:* 125 or 42, 213, Math. 121. Three hours. Alternate years.

257 Modern Astrophysics. Stellar structure and evolution, compact objects, the interstellar medium, galactic structure, gravitational theory, cosmology, the formation of our solar system, and terrestrial life. *Prerequisites:* One year calculus-based physics course. Math. 121 strongly recommended, or equivalent. Three hours. Alternate years.

258 Relativity. Development of Einstein's theory of special relativity. Lorentz transformation, time dilation, length contraction, mass variation, relative velocities. Introduction to four-dimensional space. Concepts of general relativity. Applications selected from astrophysics, elementary particles, etc. *Prerequisite:* 128 or equivalent. Three hours.

264 Introduction to Elementary Particles. Theoretical and experimental aspects of elementary particles including their properties, classification schemes, symmetries, conservation laws, fundamental interactions, models of particle structure, special topics as time allows. *Prerequisites:* 128, 213. Three hours.

265 Thermal Physics. Thermodynamics, kinetic theory, statistical mechanics. *Prerequisites:* 128 or 42, 22, Math. 121 or equivalent. Three hours. Alternate years.

273 Quantum Mechanics I. Introduction to nonrelativistic quantum mechanics. Schroedinger equation and applications to simple systems. *Prerequisites:* 128, 211. Three hours.

295, 296 Special Topics. Lectures, readings, or laboratory studies. Format and subject matter at the instructor's discretion. *Prerequisite:* Permission of instructor. Credit as arranged.

301 Mathematical Physics. Introduction to basic mathematical methods of theoretical physics; vector and tensor analysis, partial differential equations, orthogonal functions, complex variables and variational techniques. *Prerequisites:* 211, 214. Three hours. Alternate years.

311 Advanced Dynamics. Classical mechanics presented as the basis of the concepts and methods of modern physics. Variational, Lagrangian, and Hamiltonian formulations, canonical transformations, continuous systems. *Prerequisite:* 211. Three hours. Alternate years.

313 Electromagnetic Theory. Development of Maxwell's theory of electromagnetism emphasizing its physical basis and the modes of mathematical description. *Prerequisite:* 214. Three hours. Alternate years.

321 Seminar in Theoretical Physics. For research students interested in pursuing topics of general and departmental research interest in theoretical physics. *Prerequisite:* Permission of instructor. Offered as occasion warrants. Credit as arranged.

323 Seminar in Contemporary Physics. Topics of current interest in physics to be offered as student and faculty interest warrants. May be repeated for credit with departmental approval. *Prerequisite:* Permission of instructor. Credit as arranged.

331 Seminar in Biological Physics. For research students in the field of biological physics. Lectures, reports, and directed readings related to the research of the Department and the field generally. May be repeated for credit with departmental approval. *Prerequisite:* Permission of instructor. Credit as arranged. Offered as occasion warrants.

341, 342 Solid State Physics. Introduction to crystal symmetry and the reciprocal lattice. Crystal binding and lattice vibrations. Thermal, electrical, and magnetic properties of solids, free electron theory of metals, and band theory. *Prerequisites:* 214, 265, 273 or their equivalents; permission of instructor. Three hours. Alternate years.

351 Seminar in Physics of Materials. For research students in the field of the physics of materials. Lectures, reports, and directed readings related to the research for the department and the field generally. May be repeated for credit with departmental approval. *Prerequisite:* Permission of instructor. Credit as arranged. Offered as occasion warrants.

362 Quantum Mechanics II. Mathematical and physical foundations of nonrelativistic quantum mechanics from the unifying point of view of Dirac. Symmetry operations and the algebraic structure of quantum mechanics are emphasized. *Prerequisite:* 273. Three hours. Alternate years.

375 Kinetic Theory and Statistical Mechanics. Review of thermodynamics. Elements of kinetic theory including the Boltzmann equation, H Theorem and transport phenomena. Introduction to equilibrium statistical mechanics, both quantum and classical. *Prerequisites:* 265, 273. Three hours.

381, 382 Problems in Engineering Physics. Directed readings and independent study in one or more topics in engineering physics, leading to a written report and an oral presentation. Four to six hours. Graduate credit only.

391 Master's Thesis Research. Credit as arranged.

491 Doctoral Dissertation Research. Credit as arranged.

Physiology and Biophysics (PSLB)

Professors Alpert (Chair), Evans, Gibbons, Hendley, Low, McCrorey, Patlak, Warshaw; Associate Professors Hamrell, Osol, Periasamy, Webb; Assistant Professors Haeberle, Slinker; Research Professor Maughan; Research Associate Professors Mulieri, Stirewalt; Research Assistant Professors Blanchard, Mitchell, Woodcock-Mitchell.

Specific areas of research involve: the molecular basis of contraction in smooth, skeletal and cardiac muscle, including muscle mechanics, energetics, molecular biology, contractile protein biochemistry and regulation, electrophysiology, excitation-contraction coupling, and protein synthesis and turnover; cellular and mechanical regulation of lung function, including properties of cells in vascular, bronchial and alveolar tissue; control of cellular growth and differentiation, including regulation of gene expression by growth factors, hormones and mechanical stretch; chemical signaling in cellular communication, including kinetics of single sodium and calcium channels, cholinergic and adrenergic receptor function, and the neurochemical correlates of hyperactive behavior and hypertension in rodent models; cardiovascular regulation, including changes in pregnancy and changes in cation transport associated with human hypertension.

Except under special circumstances, admission and award of financial support will be restricted to Ph.D. applicants.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

Satisfactory performance on general (aptitude) section of Graduate Record Examination. Year courses in biology, organic chemistry, and physics. These requirements must be completed by the end of the first year of residency.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

Satisfactory completion of basic courses and comprehensive exam; formation of studies committee.

MINIMUM DEGREE REQUIREMENTS FOR MASTER OF SCIENCE

PSLB 301, 303, 308, 323; Biochemistry 301–302; other graduate courses as arranged (three hours minimum); thesis research (six to 15 hours).

REQUIREMENTS FOR ADMISION TO GRADUATE STUDIES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Biology, one year; chemistry, organic and physical; physics, one year; mathematics, through calculus. These requirements must be completed by the end of the first year of residency. Satisfactory performance on general (aptitude) section of Graduate Record Examination. A master's degree is not a prerequisite for the Ph.D. degree.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Satisfactory completion of basic courses and comprehensive exam; formation of dissertation committee.

MINIMUM DEGREE REQUIREMENTS

PSLB 301, 303, 308, 323; Biochemistry 301–302; in addition, 21 elective credits, six of which must be in the Department; dissertation research, minimum 20 hours. Other requirements are flexible and will be determined for each individual after consultation with the Studies Committee.

COURSES OFFERED

301 Medical Physiology and Biophysics. Function in the whole human organism, and at the cellular, tissue, and organ levels, considered biologically and physically. *Prerequisite:* Permission of department chair. Eight hours. Staff.

302 Neuroscience. A correlated presentation of the neuroanatomy and neurophysiology of mammalian CNS. Same course as Anatomy 302. *Prerequisite:* Permission of instructor. Four hours. Anatomy and Physiology staff.

303 Special Topics in Physiology. Topics of current interest to the individual faculty will be covered in depth during individual, 6-week long minicourses of one credit hour each, offered in succession throughout the calendar year. Each topic will be repeated approximately every two years. Format will include lectures, reports, and directed readings. *Prerequisites:* 301; permission of individual faculty.

308 Biometrics and Applied Statistics. Introduction to the rational use and evaluation of statistical methods in planning experiments and interpreting biological data. Biometrics laboratory included. Course limited to 12 students. *Prerequisites:* Math. 110 or equivalent, and permission of instructor. Five hours. McCrorey. Fall.

310 Molecular Basis of Biological Motility. Molecular basis of muscle contraction, and cellular motility. Topics include: muscle energetics and mechanics, biochemistry of motility, and regulation of contractile proteins. Lectures and conferences. *Prerequisites:* 301; Biochemistry 301, 302; permission of instructor. Three hours. Warshaw/staff. Alternate years.

313 Seminar on Endocrine Physiology. Devoted to a study of current problems in endocrine research with major emphasis on the molecular mechanism of action of hormones. *Prerequisites:* 301; Biochemistry 301, 302; permission of instructor. Three hours. Low. Alternate years.

323 Principles and Elements of Biomedical Instrumentation. Instrument methodology for biological research. Topics: basic electrophysics; transducers; concepts and manipulation of bioelectric and other signals; the computer as a laboratory instrument. Lectures and laboratory. *Prerequisite:* Permission of instructor. Five hours. Patlak/staff. Alternate years.

381 Seminar. Presentation and discussion by advanced students, staff, and invited speakers, of current topics in physiology. No credit will be given, but students are expected to participate.

391 Master's Thesis Research. Credit as arranged.

491 Doctoral Dissertation Research. Credit as arranged.

Plant and Soil Science (PSS)

Professors Bartlett, Boyce, MacCollom, Magdoff (Chairperson), McLean, Murphy, Parker, Pellett; Assistant Professor Mzamane; Extension Professors Costante, Gotlieb; Extension Associate Professors Berkett, Bosworth, Jokela, Perry; Lecturer Harper.

Current research projects are concerned with the solution of horticultural and agronomic problems with special emphasis on environmental physiology, soil chemistry, pasture management, plant nutrition, and pest management. Areas of research include winter hardiness of fruits, and woody and herbaceous ornamentals; cultural and environmental interrelationships as they affect plant growth, crop adaptation, and variety; pasture production and marginal land utilization; crop establishment and soil productivity; soil chemistry of the rhizosphere; redox reactions in soils; the behavior of heavy metals; compost and organic matter research; behavior of nitrogen in the soil; nutrient availability to plants; agricultural waste management; biological control of insects, disease, and weeds; integrated pest management for control of insects, diseases and weeds. A student's thesis research will be an integral part of the on-going research efforts of the department.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

An undergraduate major in an appropriate agricultural, environmental, biological, or physical science. Satisfactory scores on the Graduate Record Examination, general (aptitude) section.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

Satisfactory completion of one academic year of graduate study in the Department of Plant and Soil Science, a written or oral comprehensive examination. The decision on the type of comprehensive exam will be made by the major professor after consultation with the student.

MINIMUM DEGREE REQUIREMENTS

Eighteen to 22 hours in Plant and Soil Science and closely related fields; satisfactory participation in seminars during residency; thesis research (eight to 12 hours).

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

An undergraduate major in an appropriate agricultural, environmental, biological, or physical science. Satisfactory scores on the Graduate Record Examination, general (aptitude) section.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Satisfactory completion of two academic years of graduate study in the Department of Plant and Soil Science at The University of Vermont. With the approval of the Dean of the Graduate College and the Department of Plant and Soil Science, a master's degree may be accepted in partial fulfillment of this requirement.

Satisfactory completion of a written and oral qualifying doctoral examination as prescribed by the Department.

A reading knowledge of a modern foreign language appropriate to the student's specialty. Proficiency in other areas appropriate to the student's specialty may be substituted for the language requirement with the approval of the Studies Committee. This proficiency does not count toward course requirements for the degree.

MINIMUM DEGREE REQUIREMENTS

The course requirements are as follows: a total of at least 40 credit hours of which a minimum of 30 must be taken in Plant and Soil Science and closely related disciplines (e.g. botany, chemistry, forestry, microbiology, and biochemistry, geology). Satisfactory participation in seminars during residency is required. All doctoral students must take part in the Department's undergraduate teaching program.

COURSES OFFERED

205 Mineral Nutrition of Plants. See Botany 205. Alternate years.

207 Water Relations of Plants. See Forestry 229. Alternate years.

210 Soil Eroison and Conservation. General hydrological processes involved in surface runoff and resultant soil erosion; land management techniques for controlling soil and sediment pollution. *Prerequisites:* 161, Math. 2 or 9, Chemistry 3 or equivalent. Three hours. Alternate years.

215 Weed/Crop Ecology. Weed identification, reproduction, ecological relationships with crops, and integrated management. Alternate years.

217 Pasture Production and Management. Physiological and ecological relationships of pasture plants, effects of grazing livestock on them, grazing management effects on livestock and pastures; emphasis on French Voisin system of rational grazing. *Prerequisites:* 11, 161 or equivalent. Three hours. Murphy. Alternate years.

221 Tree Fruit Culture. Theory and practice of modern commercial fruit science. Nutrition and cultural responses to various management practices. *Prerequisites:* 11, 61 or equivalent. Three hours. Boyce.

232 Biological Control of Insect Pests. A survey of the biological agents used in controlling insects and related arthropods, and their application and limitations. *Prerequisite:* An intermediate course in entomology. Three hours. MacCollom. Alternate years, 1992–93.

242 Plant Tissue Culture. Survey the uses and potentials for plant cell and tissue culture including micropropagation, virus elimination, protoplast culture, embryogenesis, and pollen cell culture. *Prerequisites:* 11 or BOT 4 or Biology course, and permission of instructor. Three hours. A. McCoy, R. McCoy. Alternate years, 1993–94.

261 Soil Classification and Land Use. The development and classification of soils throughout the U.S. and the world as they relate to natural ecosystems and land use. One Saturday field trip. *Prerequisite:* 161 or a total of six hours in ecology, geography, or geology or permission of instructor. Three hours. Harper. Alternate years, 1992–93.

264 Chemistry of Soil and Water. A biologically biased study of the colloidal chemistry of soil and its interfaces with roots, water, and air. *Prerequisites:* 161 or permission of instructor, two semesters chemistry. Four hours. Magdoff. Alternate years, 1992–93.

266 Soil Physics. Mathematical and physical principles of the soil-water-plant interaction and its relationship to production and management. *Prerequisites:* 161 or permission of instructor, one semester of physics. Three hours. Jokela. Alternate years, 1992–93.

281 Seminar. Presentation and discussion of papers on selected topics of current interest by students and staff. *Prerequisite:* Permission of instructor. One hour. Staff.

297 Special Topics. Lectures, laboratories, readings, field projects, surveys, or research designed to provide specialized experience in horticulture, agronomy, soils, entomology, and integrated pest management. *Prerequisites:* Permission of instructor. One to three hours. Staff.

301 Plant Science Colloquium. Graduate student and staff discussion of current research topics in plant science. One hour. Staff.

302 Soil Science Colloquium. Graduate student and staff discussion of current research topics in soil science. One hour. Staff.

381 Graduate Special Topics. Advanced readings and discussion of horticulture, crops, or soils research literature. Three hours. Staff.

391 Master's Thesis Research. Credit as arranged.

491 Doctoral Dissertation Research. Credit as arranged.

Political Science (POLS)

Professors Elliott, Moyser, Pacy, Wertheimer; Associate Professors Bryan, Burke (Chair), Feldman, Nelson, Rice (Director of Graduate Studies), Stavrakis; Assistant Professors Altemus, Burgin, Forrest, Gierzynski, Kaufman, Moyano, Neal, Taylor, Thomas, Tubbs, Zheng.

Research interest of the Department of Political Science and the various library and data processing resources available enable graduate students to undertake research in American political institutions; public law; public policy; political behavior; comparative political systems; international relations; political philosophy and empirical political theory.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF ARTS

Twelve hours of political science at the junior-senior level; supporting courses in other social sciences; satisfactory scores on the Graduate Record Examination, including the subject (advanced) examination in political science.

MINIMUM DEGREE REQUIREMENTS

An approved program of 24 hours in course work, including Political Science 283 and not more than six hours in related fields; thesis research (six hours).

COURSES OFFERED

Admission to the following courses for graduate credit requires the approval of the Department.

Prerequisites for all courses: as listed or equivalent, or by permission of instructor.

221 Urban Government and Politics. An analysis of metropolitan governments, and their problems and roles. *Prerequisites:* 21, three hours at the 100 level. Three hours.

222 Constitutional Law II. Selected topics in constitutional law. *Prerequisite:* 122. Three hours.

223 The American Bureaucracy. An examination of the history, current structure, politics, behavior, reform, and accountability of the American federal bureaucracy. *Prerequisite:* 126. Three hours. Cross-listing: MPA elective.

224 State Administration. Problems in planning, policy development, and program coordination. *Prerequisite:* 126. Three hours.

225 Intergovernmental Relations. Problems of the federal system. National-state-local cooperative administration of selected public functions. *Prerequisites:* 21, three hours at 100 level. Three hours.

226 Topics on the Presidency. Further study of the executive branch and its operations. Selected topics, e.g., presidential decision making, White House staffing and operations, congressional-executive relations. *Prerequisite:* 124. Three hours.

227 Topics in Public Administration. The political problems of the administrative state. *Prerequisite:* 126. Three hours.

228 Congress and Foreign Policy. Congress's role in foreign policy making, with an emphasis on congressional action in the post-Vietnam period. *Prerequisite:* 21, three hours at 100 level or permission of instructor. Three hours.

229 Seminar in American Politics. Three hours.

241 Justice and Equality. (Same as Philosophy 242). An examination of contemporary normative theories of distributive justice and equality. *Prerequisites:* 41, or Philosophy 1 or 2 or 3 or 4, three hours at 100 level. Three hours.

242 American Political Thought. American political thought from the colonial period to recent times. *Prerequisites:* 41, three hours at 100 level. Background in American history strongly recommended. Three hours.

243 Democratic Theory. The course aims at developing an understanding of the nature of democracy. Both contemporary debates within democratic theory and the classical sources of democratic theory are examined. *Prerequisites:* 41, three hours at 100 level. Three hours.

249 Seminar in Political Theory. Three hours.

251 Foreign Policy of the U.S.S.R. and its Successor States. Historical topical study of the foreign relations of the U.S.S.R. and its successor states since 1917. *Prerequisites:* 51, three hours at the 100 level. Three hours.

252 Craft of Diplomacy. Emphasis on experiences and reflections of diplomatic personalities, supplemented by studies of specialists. *Prerequisites:* 51, three hours at the 100 level. Three hours.

253 Defense Politics. U.S. defense politics, policies, and processes. Civil-military relations, strategic policy, arms control, defense-industrial complex, defense budget. *Prerequisite:* 151. Three hours.

254, 255 International Law I, II. Principles and applications of public international law. *Prerequisites:* For 254: 51, three hours at 100 level. For 255: 254. Three hours.

256 Marxism in the Third World. Explores Marx's theory of revolution, Marx's writings on the Third World, and contemporary Marxist writings on the Third World. Second part of the course focuses on revolutionary strategies and country case studies. *Prerequisites:* 41, 51, 71, three hours at 100 level. Three hours.

257 Politics of European Integration. Survey of the European Community, including development, public opinion, institutions, internal policies, external relations and future prospects. Three hours.

259 Seminar in International Relations. Three hours.

271 Peasants, Politics, and Rebellion. Peasants as political actors with a focus on rural ecology and economy, peasant mentality and culture, and theories of rural rebellion and revolution. *Prerequisites:* 71, three hours at 100 level. Three hours.

272 Eastern European Political Systems. Examination of Eastern European political systems with emphasis on the role of ethnic conflict and Marxist-Leninist ideology. *Prerequisites:* 71, three hours at 100 level. Three hours.

273 Comparative Judicial Systems. The political roles of courts in modern democracies, e.g. Sweden, England, France, Germany, Italy, Canada, the United States, Australia, and Japan. *Prerequisites:* 71, three hours at 100 level, or 121. Three hours.

274 Comparative Legislative Behavior. The important structures, processes, and functions of legislative institutions in a variety of Western and non-Western societies with discussion of comparative research methodologies. *Prerequisites:* 71, three hours at 100 level. Three hours.

275 Comparative Federalism. Comparative study of federal political institutions and political behavior in Canada, the United States, Australia, and Germany. *Prerequisites:* 71, three hours at 100 level. Three hours.

276 British Politics. Topics include the role of the citizenry; the character of political and governmental institutions; and policy making in particular fields. Northern Ireland is also covered. *Prerequisite:* 171. Three hours.

277 Comparative Ethno-Nationalism. Ethnicity and nationalism in Europe, Asia and Africa. Political, historical, social, and economic factors are examined comparatively. Three hours.

279 Seminar in Comparative Politics. Three hours.

283 Methods of Political Science Research. An examination of advanced problems in political methods. Topics include: measurement, correlation, multiple regression, and scaling techniques. *Prerequisite:* 181. Three hours.

284 Public Opinion: Theory and Research I. (Same as Sociology 241.) *Prerequisite:* 181 (Sociology 100). Three hours.

285 Public Opinion: Theory and Research II. (Same as Sociology 242.) An examination of the theories of public opinion. Topics include: attitude formation and change, political ideology, alienation and allegiance, political socialization, tolerance, and political extremism. *Prerequisite:* 284 (Sociology 241). Three hours.

287 Participation and Democracy. Political participation in selected Western democracies. Topics include the structure of participation; social bases of political activism; protest; mass-elite linkages. *Prerequisites:* 81, three hours at 100 level. Three hours.

289 Seminar in Political Behavior. Three hours.

297, 298 Readings and Research. For advanced undergraduate and graduate students. Three hours.

391 through 393 Master's Thesis Research. Credit as arranged.

Psychology (PSYC)

Professors Emeriti Albee, Ansbacher; Professors Achenbach, Bond, J. Burchard, Crockenberg, Forgays, Howell, Joffe, Kapp, Lawson, Leitenberg, Musty, Rosen, Taylor; Associate Professors Bouton, Bronstein, S. Burchard, Compas, Gordon, Hasazi, Hughes, Kessler, Leff, Miller, Rothblum, Yadav; Research Associate Professors Belenky, Carling, Solomon; Clinical Associate Professors Dietzel, Peyser; Research Assistant Professors Besio, Bickel, Hamilton, Higgins, Livingston, Supple, Widrick; Clinical Assistant Professors Butler, Cioffari, Does, Fondacaro, McKenna, Willmuth.

The Ph.D. Program in General and Experimental Psychology includes ongoing research in a variety of areas. Details are available on request from the Chairperson, Department of Psychology. Students in this program are involved early in independent research projects. Further information on specific program specialties can be obtained from the Chairperson, Department of Psychology, or the directors of the Clinical or General/Experimental Programs.

The Ph.D. program in Clinical Phychology places equal emphasis on research and clinical training. The clinical program is fully accredited by the American Psychological Association. Further information on the types of clinical facilities and the research interests of the clinical faculty can be obtained from the Director of the Clinical Program, Department of Psychology.

The General/Experimental Program offers training in areas such as physiological, developmental, and social psychology, learning theory, organizational behavior, and developmental disabilites. Further information on the experimental program and the available opportunities are available from the director of the program.

Applicants must apply for the Ph.D. degree only. Students whose goal is a terminal master's degree are not accepted. The application deadline for admission is February 1. All supporting materials, including GRE scores, must be received by February 1.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF ARTS

A major or its equivalent in undergraduate psychology including courses in statistics and experimental psychology; satisfactory scores on the Graduate Record Examination, including the subject (advanced) subtest in Psychology.

MINIMUM DEGREE REQUIREMENTS FOR MASTER OF ARTS DEGREE

Twenty-four hours of psychology courses and seminars, including Psychology 301, 302, 340, 341; thesis research for six credits. The requirements of the specific courses (301, 302, 340, 341) may be exempted by examination. There is no foreign language requirement.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

A major or its equivalent in undergraduate psychology including courses in statistics and experimental psychology; satisfactory scores on the Graduate Record Examination, including the subject subtest in Psychology. A telephone interview is required of top applicants to the Clinical Program.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

For the General/Experimental Program, satisfactory completion of minimum degree requirements for Master of Arts degree or equivalent; for the Clinical Program, satisfactory performance on the Ph.D. comprehensive examination.

MINIMUM DEGREE REQUIREMENTS FOR THE DOCTOR OF PHILOSOPHY DEGREE

Both the General/Experimental and the Clinical Program require a minimum of 75 credit hours. However, each program requires proficiency in several specific areas. In order

to achieve such proficiency, most students must complete a total of 80 to 83 credit hours. A minimum of 20 credits must be accumulated in dissertation research and the remainder in course credits numbered in the 200 through 400 sequences of the psychology curriculum, or acceptable courses at the 200 or 300 level from other curricula. Detailed information on courses of study is available from the Department. Satisfactory performance on the department final oral examination. There is no foreign language requirement. Both programs have a required preliminary examination.

COURSES OFFERED

Psychology graduate students meet prerequisites for all 200-level courses. Other graduate students must have equivalent prerequisites or permission of instructor.

205 Learning. Analysis of theory and research on the basic learning process and behavior. *Prerequisite:* 110. Three hours. Bouton.

206 Motivation. Theory and research on the nature of motives, their influence on behavior, and their relation to other psychological processes. *Prerequisite:* 110 or 101. Three hours. Forgays.

207 Thinking. Survey of cognitive psychology, examining theory and research on perception, memory, language, cognition, and their interactions. *Prerequisite:* 110 or 101. Three hours. Gordon.

220 Animal Behavior. Behavior of animals under controlled experimental conditions and in their natural environments. Consideration of antecedents of behavior and of its adaptive significance, evolution, and development. *Prerequisite:* 110 or 101 or ZOOL 102. Three hours. Bouton.

221 Physiological Psychology I. Structure and function of mammalian nervous system, emphasizing neurological correlates of sensory experience and perception. Individual laboratory experience. *Prerequisite:* 110. Four hours. Kapp.

222 Physiological Psychology II. Study of role of central nervous system mechanisms in determination of innate behavior arousal, motivation, learning, and memory. Individual laboratory experience. *Prerequisite:* 221. Four hours. Kapp.

223 Psychopharmacology. Effects of drugs (both medical and recreational) on behavior. Topics such as drug effects on learning, memory, motivation, perception, emotions and aggression. *Prerequisites:* 110 or 101, 121 or 222. Three hours. Musty.

230 Advanced Social Psychology. Advanced survey of current research on the behavior of individuals in social situations. *Prerequisite:* 110 or 101 or 130. Three hours. Miller.

231 Psychology of Women. Psychological theories about women and research on women's roles. Biological, personality, cognitive, and developmental factors considered. *Prerequisite:* One psychology course at the 100 level. Three hours. Rothblum.

233 Psychology of Experience and Creativity Enhancement. Explores psychological processes for developing creative thinking and for enhancing the quality of conscious experience. Emphasizes personal growth as well as theoretical understanding. *Prerequisite:* Advanced background in at least one relevant field such as psychology, environmental studies, art, or education. Three hours. Leff.

234 Psychology of Social and Environmental Change. Examines psychological foundations of beneficial changes in social and physical environments. Emphasizes action strategies and projects as well as utopian visions. *Prerequisite:* Advanced background in psychology or in environmental studies or a social science. Three hours. Leff.

236 Theories of Human Communication. The study of the role of perception, human information processing, language, nonverbal codes, meaning, cognition, and interpersonal and sociocultural context in human communication process. *Prerequisite:* 109 or 101 or 130. Three hours. Yadav.

237 Cross-Cultural Communication. Study of cultural factors, cognitive processes, communication patterns and problems in cross-cultural communication; role of communication in development and social change in third-world countries. *Prerequisite:* 109 or 101 or 130 or 230. Three hours. Yadav.

240 Organizational Behavior. Study of the impact of macro and micro features of organizations (culture, systems, and individuals) upon leadership, decision-making, group processes, conflict and organization development. *Prerequisite:* 1, 109–110, or permission of instructor. Three hours. Lawson. Cross-listing: MPA.

250 Introduction to Clinical Psychology. Basic principles of interviewing, testing, assessment, report writing. Examination of common approaches to psychotherapy: clientoriented, habit change, cognitive change, emotional change, interpersonal relations, group therapy approaches. *Prerequisite:* 110 or 101. Three hours. Bronstein, Compas, Kessler.

251 Behavior Disorders of Childhood. An overview of theory, research, and practice in developmental psychopathology from infancy through adolescence. The major disorders of social and emotional development are reviewed. *Prerequisites:* 161, 109 or 101 (109 may be taken concurrently). Three hours. Hasazi.

253 Advanced Behavior Modification. Application of techniques for the modification of human behavior in a variety of educational and social situations involving the collection and analysis of behavioral data. *Prerequisites:* 109 or 101, 152. Three hours. J. Burchard.

257 Personality. The understanding of personality development and human behavior from a psychoanalytic, humanistic, trait measurement, and sociocultural perspective. *Prerequisite:* 109 or 101. Three hours. Bronstein.

261 Cognitive Development. Examination of research and theory concerning developmental changes in the human processing of information from infancy to adulthood centered on the work of Piaget. *Prerequisites:* 161 or 109 (may be taken concurrently), or 101. Three hours.

262 Social Development. Examination of theory and research concerning interpersonal development in humans from infancy through adulthood. Relationships between cognition, and social development are emphasized. *Prerequisites:* 161 or 109 (may be taken concurrently), or 101. Three hours. Crockenberg.

263 Disabilities of Learning and Development. Seminar in etiology, treatments, prevention of developmental and learning disabilities within framework of current service and educational practice. Ethical, legal, and psychological issues are examined. *Prerequisites:* 161 or other 100 level course or advanced standing in Education or Allied Health. Three hours. S. Burchard.

264 Developmental Psychobiology. Analysis of research on development of humans, animals, emphasizing effects of events in prenatal, early neonatal periods, development of physiological systems affecting behavior, evolutionary origins of behavior. *Prerequisite:* 110 or 101 or 121 or 161. Three hours. Joffe.

266 Communication and Children. Study of the role of communication, especially television in cognitive and social development from preschool to adolescence. Relationship between television violence and abnormal behavior examined. *Prerequisite:* 109 or 101 or 161 or 163. Three hours. Yadav.

295, 296 Contemporary Topics. Three hours.

The prerequisite for all of the courses listed below is acceptance to the graduate psychology program, which involves the satisfactory completion of undergraduate courses in experimental psychology, systems of psychology, and statistics. In special cases, these prerequisites may be waived by permission of the instructor.

305 Seminar in Learning Theory. Analysis of selected topics in learning and behavior theory, such as Pavlovian and instrumental learning, acquired motivation, and biological constraints on learning. Three hours. Bouton.

315 Seminar in Alcohol and Behavior. A study of the influences of alcohol upon selected aspects of psychological processes including perception, attention, cognition, learning, motivation, and emotion. Three hours. Musty.

326 Central Processes: Cortical Mechanisms. Advanced studies of the prosencephalic systems in cognitive behavior, with reference to cortical function and its relationship to input and output systems. Three hours. Kapp, Musty.

331 Interpersonal Processes: Modes of Interacting. Examination of interpersonal conflict, cooperation, power relations, information transfer, and persuasion. *Prerequisite:* Permission of instructor. Three hours. Leff.

332 Interpersonal Processes: Cognition in Social Behavior. Examination of social attribution, interpersonal set, perspectives in social encounter, and the formulation of interpersonal strategies. *Prerequisite:* Permission of instructor. Three hours. Leff.

334 Organizational Behaviors and Cultures. Examination of the impact of various organizational cultures upon leadership, personnel selection, group processes, motivation, entrepreneurship, decision making, conflict, negotiation strategies, and organizational development. *Prerequisite:* Permission of instructor. Three hours. Lawson. Cross-listing: MPA.

340 Advanced Statistical Methods I. Statistical methods for evaluating psychological data. Emphasizes exploring data with respect to research hypotheses. Critical study of hypothesis tests on means, chi-square, and correlational techniques. Three hours. Howell.

341 Advanced Statistical Methods II. Continuation of 340. In-depth study of the analysis of variance and multiple regression. Further study of analysis and interpretation of data from the behavioral sciences. *Prerequisite:* 340. Three hours. Howell.

344 Experimental Design. Extended coverage of problems in design, analysis of behavioral experiments including repeated measures, interactions, confounding, comparisons, missing data, modeling, Latin squares, other complex designs, covariance design, interpretations. *Prerequisite:* 340. Three hours. Gordon, Howell.

347 Measurement and Scaling. Traditional psychophysical methods, Thurstonian judgmental methods, recent topics in unidimensional scaling. Techniques, applications in multidimensional scaling. Relation of these to mental test theory, factor analysis, cluster analysis. *Prerequisites:* 340, 341. Three hours. Gordon.

349 Seminar in Psychology Research Methodology. For advanced psychology graduate students. Topics may include but are not limited to: factor analysis, discriminant function analysis, multivariate analysis of variance, advanced experimental design, computer application in data collection and analysis. *Prerequisite:* 341 or permission of instructor. Three hours. Gordon, Howell.

350 Family Therapy. An exploration of current theories and techniques in family therapy, through readings and discussion, as well as observation of taped and live family therapy sessions. Graduate standing in Clinical Psychology, or permission of instructor. Three hours. Bronstein.

351 Behavior Therapy: Adults. Review of literature relating to theory, practice, research. Emphasis on the evaluation of a variety of procedures applied to behavior disorders in adults. *Prerequisite:* Permission of instructor. Three hours. Leitenberg.

352 Behavior Therapy: Children. Review of literature relating to theory, practice, research. Emphasis on the evaluation of a variety of procedures applied to behavior disorders in children. *Prerequisite:* Permission of instructor. Three hours. J. Burchard.

353 Introduction to Clinical Human Neuropsychology. Clinical seminar on effects on human behavior of neocortical dysfunction. Review of theoretical, clinical approaches to brain function, emphasis on recent developments in diagnostic techniques, ensuing theoretical developments. *Prerequisite:* 221, 222 or equivalent. Three hours. Peyser.

354 Psychopathology I. An advanced course dealing with models of classification, diagnosis, epidemiology of behavior disorders in children. *Prerequisite:* Permission of instructor. Three hours. Hasazi.

355 Psychopathology II. An advanced course dealing with models of classification, diagnosis, epidemiology of behavior disorders in adults. *Prerequisite:* Permission of instructor. Three hours. Rothblum.

356 Mental Retardation. Study of abnormal behavioral development in the intellectural area. Etiology, assessment, and modification of mental retardation. *Prerequisite:* Permission of instructor. Three hours. S. Burchard, Hasazi.

359 Interpersonal Psychotherapy. An examination of psychotherapy as an interpersonal process. Resistance, transference, and counter-transference examined as interpersonal interactions and related to interpersonal personality theory. *Prerequisites:* Advanced graduate standing, permission. Three hours. Kessler.

360 Methods and Models of Clinical Prediction. Study of clinical versus actuarial problems in applied psychology. Historical antecedents, examples of problems of reliability, validity, utility models of intelligence and personality. Modern day solutions. *Prerequisite:* 340 or permission of instructor. Three hours. Kessler.

361 Advanced Personality Theory. Personality development from a psychoanalytic, humanistic, trait, and sociocultural perspective. Also, methods of personality measurement, such as scale construction and the analysis of fantasy and projective material. *Prerequisite:* Permission of instructor. Three hours. Bronstein.

362 Community Clinical Psychology. Seminar examining community intervention strategies for psychological problems and health risk behaviors. Topics: history of community psychology, discussion of intervention programs, consultation issues, research. *Prerequisite:* Permission of instructor. Three hours.

363 Advanced Primary Prevention. Review of research literature on prevention of psychopathology and promotion of competence; development of model prevention programs; evaluation, ethical issues, and political issues. *Prerequisite:* Permission of instructor. Three hours. Albee.

364 Professional Affairs and Ethics. The origins of professions and of psychology in particular. Accreditation, laws affecting psychology, organization of the profession, licensing certification, and the code of ethics for psychology. *Prerequisite:* Permission of instructor. Three hours. Albee.

365 Group Therapy. An exploration of psychotherapy and training group issues, focusing on leadership styles, group roles and stages, and research. Course will include an observation/experiential component. *Prerequisite:* Permission of instructor. Three hours. Bronstein.

366 Seminar in Advanced Developmental Psychology.

Critical Analysis of selected topics in developmental psychology. Research, theory, applied, professional issues including, for example, moral development, infancy, early conceptual development, professional writing. *Prerequisite:* Graduate standing in Psychology. Three hours. Crockenberg.

367 Human Sexual Behavior. An exploration of various topics in human sexuality including sexual behavior through the life span, sexual preference, and treatment of sexual dysfunction and deviation. *Prerequisite:* Graduate standing in Psychology or permission of instructor. Three hours. Leitenberg.

368 Psychology and Law. A study of mental health law (including the insanity defense and commitment) and of legal processes (jury decision making, jury selection, eye witness testimony). *Prerequisite:* Permission. Three hours. Kessler.

369 Health Psychology. Psychological aspects of the etiology, treatment, prevention of physical illness. Topics include: stress and disease, compliance, health care systems, coping with illness, positive health behavior. *Prerequisite:* Permission of instructor. Three hours. Rosen.

370, 371 Introductory Practicum: Assessment and Therapy I and II. Role of psychologist as consultant, emphasis on evaluation of mental abilities, behavioral, personality adjustment. Therapy practicum covers basic psychotherapy, case management, utilization of supervision. *Prerequisite:* Permission of instructor. Three hours. Compas, Kessler, Rosen.

374 Advanced Clinical Practicum. Year-long, 20 hours/week supervised service delivery (1000 hours) involving psychological intervention and consultation. Training takes place in a variety of mental health agencies. *Prerequisites:* Second-year student or above (or equivalent) in Ph.D. program in Clinical Psychology and permission. (May be taken more than once.) Three hours.

375 Internship in Clinical Psychology. Supervised service delivery (2000 hours) involving psychological intervention and consultation. Training takes place in an American Psychological Association accredited internship. *Prerequisites:* Three credits in 374, permission. Zero hours. (Note: Zero credits because instruction is done off-campus by non-UVM faculty.)

380 Contemporary Topics. Selected topics in depth, emphasis on critical analysis of original literature. Recent topics: anxiety, behavioral pharmacology, biological bases of memory, depression, organizational behavior, psychotherapy research, primate behavior, skilled performance. Three hours.

381 Clinical Research Seminar. Year-long seminar on methods and design in clinical research. Oral and written presentation of a research proposal and results. Required twice for clinical students. *Prerequisite:* Permission. Three hours. Leitenberg.

382 Advanced Research Seminar. Presentation of graduate student research and selected topics. *Prerequisite:* Graduate standing in General/Experimental Program. Three hours. Forgays.

385 Advanced Readings and Research. Readings, with conferences, to provide graduate students with backgrounds and specialized knowledge relating to an area in which an appropriate course is not offered. One to three hours.

391 Master's Thesis Research. Credit as arranged.

491 Doctoral Dissertation Research. Credit as arranged.

Not offered annually, but regular courses:

210 Principles of Human Perception

The following courses are offered infrequently but may be taught where sufficient student interest is demonstrated.

308 Seminar in Operant Conditioning. Three hours.

310 Seminar in Perception. Three hours.

333 Interpersonal Processes: Motivation in Human Interaction. Three hours.

Public Administration (MPA)

Professors Ball, Carlson, Lawson (Interim Chair), Reidel; Associate Professors Bryan, Burke, Parke, Patterson, Tashman, Ventriss; Campus Associate Professors Aleong, Woolf; Visiting Professor Smallwood; Adjunct Lecturers Burns, Haupt, Hindes, Meier, Salmon, Walton.

MPA became a department within the School of Business in August 1990. The Master of Public Administration is an interdisciplinary program providing the student with perspectives from a variety of academic and professional disciplines for the common purpose of furthering the student's ability to formulate public policy and to manage complex public and nonprofit organizations. Faculty is incorporated from the Schools of Business Administration and Natural Resources; the Colleges of Agriculture and Life Sciences and Education; and from the Departments of Political Science, Psychology, and Public Administration.

The MPA degree program is designed to:

1. Provide promising public and nonprofit sector managers with a quality educational experience covering the theories and practices of program planning and control, and the problems of policy making in an environment characterized by resource constraints and rapid social change.
2. Stimulate and focus scholarly research in the problems and issues of public organizations in Vermont as well as nationally; and
3. Facilitate mutually beneficial interaction within the community of scholars and practitioners of public administration.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF PUBLIC ADMINISTRATION

A sound academic record, satisfactory scores on the general aptitude section of the Graduate Record Examination, three letters of recommendation attesting to the candidate's academic potential for graduate work, and motivation for pursuing the MPA. Past experience as a practitioner is desired though not necessary. Persons currently employed in administrative positions are encouraged to apply.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF PUBLIC ADMINISTRATION

Successful completion of 36 credit hours, including core courses PA 301-306, an approved sequence of courses and an administrative internship, with an average of B (3.0) plus satisfactory completion of the Comprehensive Examination. A six-credit thesis-option is available to students. In addition to the requirements listed above, specific prerequisite course work may be required of those who lack a strong math and statistics or expository writing background.

Comprehensive Examination

A written comprehensive examination (GRAD 397) will be offered twice a year: March and August. The examination covers material from each of the six required core courses.

COURSES OFFERED

In addition to the six core courses and electives listed below, regular courses (200-level and above) are available in the respective academic units listed above and, with prior approval, may be included in a candidate's program.

206 Introduction to Contemporary Public Affairs. Contemporary policy issues including government and the economy, the role of leadership, ethical and moral issues in public policy and other contemporary issues impacting society. *Prerequisite:* ECON 11/12 or its equivalent recommended. Permission. Three hours. Bryan, Ventriss.

295, 296 Intermediate Special Topics. Current issues and new developments in public policy and public administration. *Prerequisite:* Permission. Three hours.

301 Public Management. Analysis of major elements of management in public sector (organization, personnel, budgeting) with special attention to problems arising from political imperatives generated by a democratic society. Three hours. Bryan, Smallwood or Ventriss.

302 Organizations in Modern Society. Examination of basic classical and contemporary theory, research on human relations, internal structures, environments, types, general properties of complex organizations, bureaucracies. Three hours. Lawson or Patterson.

303 Statistical Analysis for Public Management. Data analyses and communication of statistical information for management decision making. Methods of modeling relationships, comparing strategies, and assessing probabilities. Instruction in computer use. Additional lab required. Three hours.

304 System Analysis and Planning. An analysis of, and experience with, planning theories and techniques that derive from General Systems Theory. Three hours. Carlson. Cross-listing: EDAP 355.

305 Public Budgeting and Public Finance. A focus on the budget as the primary policy and planning document in public organizations. Three hours.

306 Introduction to Public Policy. Study of: (1) stages in the policy process; (2) development of public policy in the federal system; and (3) policy analysis and evaluation at each stage in the policy process. Three hours. Haupt or Ventriss.

307 Administrative Ethics. Administrative behavior with a focus on ethical dilemmas that arise in the bureaucracy. An examination of a number of moral issues and ways to resolve them. Three hours. Burke.

308 Decision Making Models. Introduces analytical techniques, develops proficiency in use of LOTUS 1-2-3 to augment managerial intuition, and examines the economic principles of psychology and sociology of decision making. *Prerequisites:* 303 plus one other MPA course or permission of instructor. Three hours. Tashman.

309 Administrative Theory and Practice. Extensive examination of literature pertaining to the practice and theory of public administration. Explores public/private partnerships, intergovernmental management, ethics, and administrators as agents for organizational change. *Prerequisites:* ALL core courses, 301–306. Three hours. Ventriss.

310 State Administration. Elements of public management at state level i.e. *state/federal* relationship regarding *control;* management within force field of *local* conflict and cooperation; and management within context of *inter-agency* conflict and cooperation. Three hours. Bryan. Cross listing: Political Science 224.

311 Research Methods, Policy Analysis and Program Evaluation. A seminar providing hands-on knowledge in policy analysis and program evaluation using case studies of current analysis projects and problems. Specific techniques include planning, survey administration, forecasting, cost benefit analysis and impact assessment. *Prerequisites:* 303, 306, MPA, MBA, MNR, MNURS, MPOLS, or permission of instructor. Three hours. Haupt.

312 Health Policy and Management. Addresses major issues and challenges faced by health services managers relating to established and evolving social, economic and professional policies in a context of practical problem assessment and appropriate resolution. *Prerequisites:* MPA, MNURS, or permission of instructor. Three hours. Hindes.

313 Public Policy Implementation. A seminar considering aspects of the public policy implementation process from initiation to completion and evaluation with regards to system design, policy goals, communication, compliance and political environment. *Prerequisites:* MPA, or permission of instructor. Three hours. Smallwood.

314 Administrative Law. Examines legal foundations of public administration focusing on legal issues of most importance to present or future administrators. *Prerequisite:* Permission. Three hours. Ball, Holland.

315 Health Services and Medical Care in the United States. Defines the milieu of issues and challenges faced by managers in the health services setting. *Prerequisites:* Enrollment in MPA, MNURS, or permission. Three hours. Hindes.

316 Effective Management Techniques. Concentration on leadership, role of managers, and essential components of well-managed organizations in the public, nonprofit, and private sector. *Prerequisite:* Permission. Three hours. Salmon.

380 Internship. Required of all MPA students. Supervised administrative experience culminating in a written report. Three hours.

391 Master's Thesis Research. Thesis topic must be approved by a faculty committee. Six credits.

395 Special Topics. For advanced students within areas of expertise of faculty. Varied course offerings. Contemporary topics. Permission of instructor. One to three hours.

397 Readings and Research. Readings, with conferences, term paper, to provide graduate students with specialized knowledge in an area in which an appropriate course is not offered. Three hours.

Religion (See page 104.)

Social Work (SWSS)

Professor Witkin (Chairperson); Associate Professors Burrell, Paolucci-Whitcomb, Thompson; Assistant Professors Bishop, Moroz, Roche; Lecturers Pugh, Widrick; Adjunct Assistant Professors Anderson, Edwards-Orr, Gottlieb, Weaver and Wilson.

MASTER OF SOCIAL WORK

The Master of Social Work Program (MSW) provides course work and practice experiences designed to prepare students for advanced professional roles in social work. The primary goal of the program is to educate persons for practice in diverse, social service systems. The program incorporates a variety of educational components, including classroom instruction and off-campus supervised practica in approved agency settings. Course work and the other academic experience reflect five areas: human behavior and the social environment, social welfare policy, social work practice, field, and research.

Two advanced concentrations are offered: Health/Mental Health and Children and Family Services. Each concentration includes courses in advanced practice and field experience in the student's area of interest. Advanced courses, taken by all students, in social policy, research, and human behavior and the social environment provide additional content related to their practice concentration.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SOCIAL WORK

Prospective students must meet the following minimum requirements.

1.) Earned a baccalaureate degree from an institution accredited by the Council on Postsecondary Accreditation.

2.) Attained satisfactory scores on the Graduate Record Examination (GRE). A holistic view of candidates' qualifications for graduate social work education is utilized; therefore, no minimum score for admission has been set. Applicants must submit GRE scores prior to admission.

3.) Earned a minimum grade-point average (GPA) of 2.5 (where 4.0=A) in undergraduate studies.

4.) Earned a minimum grade-point average of 3.0 in any previous graduate work in Social Work.

5.) Be in good standing from the last institution they attended.

6.) Demonstrated achievement of a liberal arts background in their undergraduate studies including a course in human biology. Students who have not completed a course in human biology (with a C- or higher) at the time of admission must complete an approved course prior to starting their program or within their first year in the program.

In addition to the above, the "personal statement" of the applicant is an essential part of the application. The written references are also important sources of information regarding the qualifications and experiences of applicants.

Applicants with a Bachelor of Social Work degree from a program accredited by the Council on Social Work Education (CSWE) may apply for Advanced Standing to the MSW program. Students granted advanced standing can waive certain program (Foundation) requirements.

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF MASTER OF SOCIAL WORK

A minimum of 60 credit hours from the following curriculum components are required. Graduates of accredited baccalaureate social work programs who are granted advanced standing generally can waive credit requirements for SWSS 212, 216, 217, 220, 221 and 227. In addition, field practica are completed within 3 semesters. For all others, the following courses are required.

FOUNDATION COURSES (30 CREDITS)

SWSS 212: Social Work Practice I	3 credits
SWSS 216: Theoretical Foundations of HBSE I*	3
SWSS 217: Theoretical Foundations of HBSE II	3
SWSS 220: Social Welfare Policies and Services I	3
SWSS 221: Social Welfare Policies and Services II	3
SWSS 227: Foundations of Social Work Research	3
SWSS 312: Social Work Practice II	3
SWSS 395: Field Practicum	6
EDSS 313: Statistical Methods in Education and Social Services**	3

*Human Behavior in the Social Environment
**May be waived on approval of prior course work or by examination. Students waiving this course must substitute an acceptable elective.

ADVANCED COURSES (30 credits)

SWSS 301: Social Work in Health	3 credits
SWSS 302: Social Work in Mental Health	3
or	
SWSS 310: Social Work with Children and Families I	3
SWSS 311: Social Work with Children and Families II	3
SWSS 316: Critical Applications of HBSE	3
SWSS 320: Advanced Social Welfare Policy Analysis and Practice	3
SWSS 327: Advanced Social Work Research	3
SWSS 395: Field Practicum	6
SWSS 398: Analytical Paper	1–6
Electives	6

Electives require advanced approval of faculty advisors.

A final analytical paper will be prepared in SWSS 398. The paper and oral examination constitutes the comprehensive examination requirement of the Graduate College.

COURSES OFFERED

200 Contemporary Issues. Content and structure may accommodate special issues not especially appropriate within the boundaries of an existing course. *Prerequisite:* Permission of instructor. One to six credits.

212 Social Work Practice I. A comprehensive introduction to concepts and skills employed by social workers in interactions and interventions with individuals, families, and groups is provided. *Prerequisite:* MSW standing or permission of instructor. Three credits.

216 Theoretical Foundations of Human Behavior and the Social Environment I (HBSE). This course introduces students to the biological, psychological, cultural/social, and economic forces that influence human behavior and their implication for social work practice. *Prerequisite:* MSW standing or permission of instructor. Three credits.

217 Theoretical Foundations of Human Behavior and the Social Environment II (HBSE). Focus is on theories regarding the nature and functioning of human service organizations and communities in relation to meeting human need. *Prerequisite:* 216 or permission of instructor. Three credits.

220 Social Welfare Policies and Services I. An introduction to history and philosophy of social work and social welfare and the structure of service programs is provided. *Prerequisite:* MSW standing or permission of instructor. Three credits.

221 Social Welfare Policies and Services II. Focus is on the analysis of the economic, political, and social forces that influence the development and implementation of social welfare policy. *Prerequisite:* 220 or permission of instructor. Three credits.

227 Foundations of Social Work Research. An introduction to qualitative and quantitative methods of applied social research including program evaluation and the evaluation of practice and application to social work is taught. *Prerequisite:* MSW standing or permission of instructor. Three credits.

301 Social Work in Health. Application of multiple levels of social work practice skills in health settings with individuals, groups, families, and communities by incorporat-

ing a family systems theory approach. *Prerequisites:* 212, 216, 220, 227 and six hours of 395 or advanced standing. Three credits.

302 Social Work in Mental Health. Advanced knowledge and skills in working with children with severe emotional disturbances and adults with persistent mental illness. Community-based services are emphasized. *Prerequisites:* Completion of foundation course work, advanced standing or permission of instructor. Three credits.

310 Social Work with Children and Families I. Focus is on families whose major task is child rearing and child caring. Covers advanced knowledge, concepts, and methods of contemporary child/family services within a family-centered approach. *Prerequisites:* Completion of foundation course work, advanced standing or permission of instructor. Three credits.

311 Social Work with Children and Families II. Focus is on families with adolescents, families with no children and families with dependent adults. Advanced analysis of families from an adult member perspective and from a critical view of family ideology and myth. *Prerequisites:* Completion of foundation course work, advanced standing or permission of instructor. Three credits.

312 Social Work Practice II. Knowledge and skills of social work practice with organizations and communities is emphasized. *Prerequisite:* Completion of 212, advanced standing or permission of instructor. Three credits.

316 Critical Applications of Human Behavior and the Social Environment. This course emphasizes advanced analyses of behavioral and social theories as related to social work practice in health and mental health and/or with children and families is required. *Prerequisite:* Completion of 216 and 217, advanced standing or permission of instructor. Three credits.

320 Advanced Social Welfare Policy Analysis and Practice. In-depth analysis of social welfare policy with application to children and families or health and mental health is required. There is an emphasis on the skills of the policy practitioner. *Prerequisite:* Completion of 220 and 221, advanced standing or permission of instructor. Three credits.

327 Advanced Social Work Research. An analysis of social work research from methodological and theoretical perspectives is emphasized. The application of research to the student's concentration area is required. *Prerequisites:* Completion of 227, EDSS 313 (or equivalent), advanced standing or permission of instructor. EDSS 313 may be taken concurrently. Three credits.

380 Professional Issues in Social Work. Designed to cover selected social work issues in depth. Major emphasis on intensive and critical analysis of the literature and practice in a given area. *Prerequisite:* Permission of instructor. Three credits.

395 Field Practicum. Supervised field experience. The foundation year placement provides experience in the application of the theory and skills of social work practice. The advanced year placement provides advanced skills related to the student's concentration area. *Prerequisite:* Permission of Coordinator of Field Education. Twelve credits.

397 Independent Study in Social Work. Individual work on Social Work issue(s) selected by the student in consultation with a faculty member. *Prerequisite:* Permission of instructor. One to six credits.

398 Analytical Paper. Identification and analysis of a social work issue related to the student's concentration area and the development of a proposal based on that analysis. *Prerequisite:* Successful completion of foundation course work and permission of instructor. One to six credits.

Sociology (See page 104.)

Spanish (See page 106.)

Statistics (STAT)

Steering Committee Members: Professors Ashikaga, Costanza, Haugh (Director), Howell, McCrorey; Associate Professors Gordon, Mickey, Newton, Son; Research Professor Aleong; Research Associate Professors McAuliffe, Williams; Lecturers Badger, Low, MacPherson, Weaver, Whitmore.

The Statistics Program offers biostatistics, statistics and probability courses for the entire University community along with traditional degree programs and individually designed degree programs emphasizing statistics applied to other fields. The degree programs are designed primarily for students who plan careers in business, industry, and government or advanced training in disciplines that make extensive use of statistical principles and methods. The Program faculty is deeply involved in consulting and collaborative research in a wide varierty of fields, including industry, agriculture and in the basic and clinical medical sciences. These research activities along with the research of participating faculty from psychology, natural resources, business and public administration, etc., offer students unique opportunities to apply their classroom training to "real world" problems. Qualified students with the goal of learning statistics to use in a specialized area of application are especially encouraged to take advantage of these cooperative arrangements.

Program faculty have active statistics research efforts in areas such as reliability, sequential analysis, time series analysis, survival data analysis, discriminant analysis, bootstrap methods, categorical data analysis, and experimental design. A track in quality and productivity improvement is available. Students seeking the traditional graduate degree in statistics (along with course work in mathematics and computer science, if desired) have excellent opportunities to participate in the faculty research. (See also Biostatistics program description, p. 38.)

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES AND ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

A baccalaureate degree. Three semesters of calculus, a course in matrix methods, and one semester of statistics. Provisional acceptance can be given prior to the completion of these requirements. Satisfactory scores on the general (aptitude) portion of the Graduate Record Examination are required for most sources of financial aid. Computer experience is highly recommended.

MINIMUM DEGREE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

Plan A: (Thesis) A 30 semester hour program requiring 24 semester hours of approved course work. This must include Statistics 221, 223, 224, 231, 251, 261, 321, 323, 324, other Statistics courses numbered above 211 or Biostatistics 200, other mathematics or quantitative methods courses or (if appropriate) courses in a specialized field of application, plus six hours of approved thesis research (391).

Plan B: (Nonthesis) A 33 semester hour program requiring 30 semester hours of approved course work. This must include Statistics 221, 223, 224, 231, 251, 261, 321, 323, 324, other Statistics courses numbered above 211 or Biostatistics 200 , other mathematics or quantitative methods courses or (if appropriate) courses in a specialized field of application, plus three semester hours of approved statistical research (381).

Under both plans, students must have or acquire a knowledge of the material in Statistics 201 and 211 in addition to their required course work. Additional specific courses may be required depending on the student's background and interest. Other courses are selected with the approval of the student's advisor from statistics, mathematics, computer science, and (if appropriate) graduate level courses from the student's intended area of speciality application (e.g. business administration, engineering, ecology, genetics, psychology). The student is expected to participate in the Colloquium series of the Program. Plan A and Plan B require successful completion of a comprehensive examination which includes coverage of theoretical and applied aspects of advanced statistics courses taken by the student. A specialized application may be included as part of the comprehensive exam if appropriate. Under Plan B a student, in lieu of a thesis, must carry out an approved comprehensive data analysis culminating in both an oral and written report to the faculty.

COURSES OFFERED

200 Medical Biostatistics. Introductory design and analysis of medical studies. Epidemiological concepts, case-control and cohort studies. Clinical trials. Students evaluate statistical aspects of published health science studies. *Prerequisites:* 141 or 211 or permission. Cross-listing: Biostatistics 200.

201 Statistical Analysis Via Computer. Intensive coverage of computer-based data preprocessing and analysis using statistical packages, subroutine libraries, user-supplied programs. Students analyze real data, prepare comprehensive report. *Prerequisites:* 111 with permission of Director, or 141, or corequisite 211 or 308. Three hours.

211 Statistical Methods I. Fundamental concepts and techniques for data analysis and experimental design. Descriptive and inferential statistics, including classical and nonparametric methods, regression, correlation and analysis of variance. *Prerequisite:* Math 19 or 21 or college algebra with instructor permission. Three hours. Cross-listing: Biostatistics 211.

221 Statistical Methods II. Multiple regression and correlation. Basic experimental design. Analysis of variance (fixed, random and mixed models). Analysis of covariance. Computer software usage. *Prerequisite:* 141 with instructor permission or any one of 211, 241, or 261. Cross-listing: Biostatistics 221.

223 Applied Multivariate Analysis. Analysis methods for categorical and continuous multivariate data. Discriminant analysis, logistic regression, canonical correlation, principal components, factor analysis and log linear models. Computer software usage. *Prerequisites:* 211 or 241 or 261, or 141 with instructor permission. Math. 124 recommended. Cross-listing: Biostatistics 223.

224 Statistics for Quality and Productivity. Statistical methods for product quality and productivity. Statistical process control. Shewhart, CUSUM, empirical Bayes control charts. Acceptance, continuous, sequential sampling. Selected statistical computer programs utilized. *Prerequisites:* Any one of 211, 241 or 261, or 141 with instructor permission. Three hours. Cross-listing: Biostatistics 224.

225 Applied Regression Analysis. Simple linear and multiple regression models; least squares estimates, correlation, prediction, forecasting. Problems of multicollinearity and influential data (outliers). Selected statistical computer programs are utilized. *Prerequisites:* Any one of 111, 141, 211, 241, or 261. Three hours. Cross-listing: Biostatistics 225.

227 Statistical Methods for the Behavioral Sciences. See Psychology 341.

229 Reliability and Survival Analysis. Probabilistic modeling and inference in reliability. Replacement, maintenance, inspection policies. Weibull, lognormal analyses. Accelerated life tests. Regression analyses with survival data; proportional hazards. Computer applications. *Prerequisite:* Any one of 211, 241, 261, or 141 plus a second statistics course. 151, Math. 121 recommended. Some computer experience desirable. Three hours.

231 Experimental Design. Randomization, complete and incomplete blocks, cross-overs, covariance analysis, factorial experiments, confounding, fractional-replication, nesting, split-plots, repeated measures, response surface optimization, Taguchi methods, and optimal designs. *Prerequisite:* Any one of 141, 211, 241 or 261. Three hours.

233 Design of Sample Surveys. Design and data analysis for sample surveys. Simple random, stratified, systematic, cluster, multistage sampling. Practical issues in planning and conducting surveys. *Prerequisites:* 211 or 241 or 261, or 141 with instructor permission. Three hours. Cross-listing: Biostatistics 233.

241 Introduction to Statistical Inference. Introduction to statistical theory: related probability fundamentals, derivation of statistical principles and methodology for parameter estimation and hypothesis testing. *Prerequisites:* Math. 121. Statistics 151 or 251 and a course in statistical methods are recommended. Three hours. Cross-listing: Biostatistics 241.

251 Probability Theory. Distributions of random variables and functions of random variables. Expectations, stochastic independence, sampling and limiting distributions (central limit theorems). Concepts of random number generation. *Prerequisite:* Math. 121; Statistics 151 or equivalent recommended . Three hours.

252a Applied Discrete Stochastic Process Models. Markov chain models for biological, social, and behavioral systems models. Decision processes for management science. Random walks, transition, and steady-state probabilities, passage, and recurrence times. *Prerequisite:* 151 or 251. One hour.

252b Applied Continuous Stochastic Process Models. Queueing models for operations research and computer science systems analysis. Birth-and-death processes with applications. Exponential, Erlang, and Poisson distributions. Monte Carlo simulation. *Prerequisite:* 151 or 251. One hour.

253 Applied Time Series and Forecasting. Autoregressive moving average (Box-Jenkins) models, autocorrelation, partial correlation, differencing for nonstationarity, computer modeling. Forecasting, seasonal or cyclic variation, transfer function and intervention analysis, spectral analysis. *Prerequisites:* Any one of 141, 211, 225, 241, or 261. Three hours. Cross-listing: Biostatistics 253.

261, 262 Statistical Theory I,II. Point and interval estimation, hypothesis testing, and decision theory. Applications to areas such as nonparametric tests, sequential analysis and linear models. *Prerequisites:* For 261: 151 with instructor permission or 251. For 262: 241 with instructor permission or 261. Three hours each.

270 Stochastic Theory in Electrical Engineering. See Electrical Engineering 270.

271 Least Squares Estimation and Filtering of Time Series. See Electrical Engineering 271.

281 Statistics Practicum. Intensive experience in carrying

out a complete statistical analysis for a research project in a substantive area with close consultation with the project investigator. One to four credit hours. *Prerequisites:* Any one of STAT 200, 201, 221 through 233, or 253. Some statistics software experience. No credit for graduate students in Statistics or Biostatistics.

295 Special Topics in Statistics. For advanced students. Lectures, reports, and directed readings on advanced topics. *Prerequisite:* As listed in course schedule. One to four credit hours as arranged.

308 Biometrics and Applied Statistics. See Physiology 308.

313 Statistical Analysis for Management. See Business Administration 313.

321,323,324,325,329 Seminars in Advanced Statistics. Seminar presentations and discussions of statistical literature pertaining to the theoretical aspects of methods studied in 221, 223, 224, 225, and 229, respectively. *Corequisites:* 221 for 321; 223 for 323; 224 for 324; 225 or 221 for 325, 229 for 329. STAT 241 or 261 recommended. One hour each.

381 Statistical Research. Methodologic or data analytic research culminating in oral and written reports to the faculty. *Prerequisite:* Consent of instructor. One to three hours.

385 Consulting Practicum. Supervised field work in statistical consulting. Experiences may include advising UVM faculty and students or clients in applied settings such as industry and government agencies. *Prerequisites:* Second year graduate standing in Statistics or Biostatistics and permission of Statistics Program Director. One to three hours.

391 Master's Thesis Research. Credit as arranged.

395 Advanced Topics in Statistics. Lectures or directed readings on advanced and contemporary topics not presently included in other statistics courses. *Prerequisites:* As listed in course schedule. One to three hours.

Vocational Education and Technology (VOTC)

Professors Chamberlain, Fuller; Associate Professors Bloom, Ferreira, Kelly (Interim Chairperson); Extension Associate Professors Harris, Patterson.

The department offers three areas of concentration:

a. Extension Education — which leads to a Master of Extension Education degree, and
b. Home Economics Education — which leads to either an M.A.T. or an M.Ed. degree, and
c. Occupational and Practical Arts Education — which leads to either an M.A.T. or an M.Ed. degree.

EXTENSION EDUCATION

The goal of this program is to improve the knowledge and competencies of the student in a career field coupled with preparation for adult educational leadership functions. Programs of study may be designed for adult educational and training responsibilities in one of the following specializations in the nonschool based setting: agricultural or related agencies and organizations, business and industry, and youth programs and organizations.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF EXTENSION EDUCATION

An undergraduate degree with an acceptable major area of specialization. An acceptable score on the Graduate Record Examination general (aptitude) section.

MINIMUM DEGREE REQUIREMENTS

A minimum of 30 semester hours in courses numbered above 200 is required. At least 12 semester hours will be completed in the College of Agriculture and Life Sciences, including at least six semester hours in education courses offered by the College of Agriculture and Life Sciences. A minimum of 18 additional semester hours will be selected to meet individualized program objectives. Normally, no thesis is required.

The candidate may complete the degree requirements through Summer Session, Evening Division, and/or full-time residency. A candidate will be expected to spend at least one semester or a minimum of two summers in residence at The University of Vermont campus in Burlington.

This requirement may be completed by an internship or practicum experience approved by the candidate's studies committee.

Comprehensive Examination

a. A written comprehensive examination in the field of specialization.
b. A comprehensive oral examination in the field of specialization.

A candidate is expected to complete at least six semester hours in the Vocational Education and Technology Department. Usually courses in political science, sociology, and/or research will be taken. Not more than six hours of independent study are allowed in a candidate's program. One year of satisfactory professional experience. Students who do not have the professional experience must complete a field experience in addition to the minimum degree requirements. Inquiries should be directed to Professor Thomas F. Patterson.

HOME ECONOMICS EDUCATION OR OCCUPATIONAL AND PRACTICAL ARTS EDUCATION

The Master of Arts in Teaching Degree Programs

The goal of these programs is to strengthen an individual's background in a teaching field. Specialized areas of interest include agriculture and natural resource education, home economics, industrial arts, industrial education, and vocational-special needs education.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF ARTS IN TEACHING

An undergraduate degree in an appropriate field of specialization. Acceptable scores on the general (aptitude) portion of the Graduate Record Examination.

MINIMUM DEGREE REQUIREMENTS

See page 20 for regulations of the Graduate College.

Candidates are expected to have completed the necessary courses to meet minimum requirements for a teaching certificate. Those who do not qualify for a teaching certificate, but have satisfactory teaching field preparation and Graduate Record Examination scores will need to complete a professional field experience in addition to the minimum degree requirements. The Department expects a candidate to complete at least 18 semester hours in professional education in his or her combined undergraduate and graduate programs, which includes preparation in the areas of foundations of education, methods of teaching, learning, theory, and human development. Usually not more than six hours of independent study are allowed. A candidate is expected to complete at least one semester or two summers in residence on The University of Vermont campus in Bur-

lington. Inquiries should be directed to Professor Thomas F. Patterson about Extension Education or Occupational and Practical Arts Education, and to Professor Valerie Chamberlain about Home Economics Education.

The Master of Education Degree Programs

The goal of these programs is to prepare individuals for professional leadership in Home Economics Education or Occupational and Practical Arts Education. Programs are planned jointly with the College of Education and Social Services in guidance and counseling, occupational education for students with special needs, or to meet individual goals as they relate to occupational and practical arts education.

The Department expects each candidacy to include study in one or more of the following areas as they relate to Home Economics Education or Occupational and Practical Arts Education: improvement of instruction and evaluation, principles and problems involved in curriculum development, planning and managing educational programs, and/or research.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF EDUCATION

An undergraduate degree in an appropriate area. Acceptable scores on the general (aptitude) portion of the Graduate Record Examination.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF EDUCATION

Eighteen hours of education courses or appropriate certification.

MINIMUM DEGREE REQUIREMENTS

A candidate is expected to complete at least one semester or two summer sessions in residence on The University of Vermont campus in Burlington. Additional information on this degree program may be found on page 52 of this catalogue. Inquiries should be directed to Professor Thomas F. Patterson, College of Agriculture and Life Sciences, about Extension Education or Occupational and Practical Arts Education, and to Professor Valerie Chamberlain about Home Economics Education.

COURSES OFFERED

251 Media, Methods, and Materials for Teaching Home Economics. Advantages, disadvantages, guidelines for using, and development of media, materials, and methods for teaching in a variety of home economics-related programs. *Prerequisite:* 52 or permission of instructor. Three hours. Chamberlain.

252 Evaluation in Home Economics, Occupational, and Extension Education. Test and questionnaire construction and nontesting means of evaluation, usability, validity, reliability, and discrimination of evaluation instruments. Selected sociometric techniques and evaluation in affective domain. *Prerequisite:* 251 or permission of instructor. Three hours. Chamberlain.

253 Curriculum Development in Home Economics, Occupational, and Extension Education. Basic principles of curriculum development applied to vocational education. Unique characteristics and contributions of vocational education as related to educational, economic, and sociological trends. *Prerequisites:* Nine hours in education or permission of instructor. Three hours. Bloom, Chamberlain.

270 Educating Students with Special Needs in Vocational Education (3-0). Legal, social, and economic forces affecting vocational programming for special needs students (handicapped and disadvantaged). Programs, resources, and procedures for educating special learners in vocational education. *Prerequisite:* Admission to an approved teacher certification program or permission of instructor. Three hours.

271 Workshop in Teaching Students with Special Needs in Vocational Settings. Intensive preparation in selecting contemporary instructional strategies and materials and in adapting and using equipment in regular and special vocational education programs. *Prerequisite:* Completion of 12 credits in Vocational or Special Education at the 100 or 200 level or permission. Offered during summer sessions. Variable credit; one to three hours; may enroll more than once for total of six credits.

273 Technical Writing. Through readings and regular writing assignments, students will learn the rhetorical art of technical writing essential for scientists and engineers. Focus is on form and content. (Fall semester for students with research data; spring semester for new graduate students.) Three hours.

275 Developing Vocational Instruction for Students with Special Needs (3-0). Focus on development of instructional strategies for including handicapped students in vocational education. Procedures for developing, implementing, and evaluating individualized vocational plans. *Prerequisite:* Admission to an approved teacher certification program or permission of instructor. Three hours.

283 Teaching Adults. Problems related to organizing and planning adult education programs for schools, community organizations, government agencies, or business. Techniques for teaching adults will be analyzed. *Prerequisites:* 82 or 52 and 182, or permission of instructor. Three hours. Kelly, Patterson.

292 Seminar. Reports, discussions, and investigations in selected fields. Students may enroll more than once for total of six hours. *Prerequisites:* Six hours 100 level and permission of instructor. One to three hours. I, II.

295 Special Topics. Lectures, laboratories, and/or readings and reports, relating to contemporary areas of study. A student may enroll more than one time and accumulate up to nine hours. *Prerequisite:* Six hours 100 level and departmental permission. Credit as arranged. I, II. Staff.

377 Practicum in Vocational and Extension Education. Advanced supervised practicum to provide direct involvement in vocational or extension education and training settings. Individually planned to apply course-related learning in an applied setting. *Prerequisites:* Completion of at least six hours in appropriate 200-level VOTC courses or permission of instructor. Variable credit: one to 12 hours.

391 Master's Thesis Research. Credit as arranged.

Water Resources

For description of the M.S. Program in Water Resources see NATURAL RESOURCES, page 79.

Wildlife and Fisheries Biology

For description of the M.S. Program in Wildlife and Fisheries Biology see NATURAL RESOURCES, page 79.

Women's Studies (See page 106.)

Zoology (ZOOL)

Professors Bell, Happ (Chairperson), Heinrich, Herbers, Van Houten; Associate Professors Davison, Kilpatrick, Landesman, Schall, Wilson; Assistant Professors Goodnight, Gotelli, Lannigan, Otter, Stevens, Vigoreaux; Adjunct Associate Professor Buonassisi; Adjunct Assistant Professors Hayashi, Jaken, Sato, Serrero, Stevens.

Faculty research interests fall into two broad groupings, developmental biology/cell and molecular biology/physiology and ecology/evolution/natural history. Current ongoing research projects include: taxonomy and natural history of insects, particularly Rhysodid beetles; parasite-host ecology, population and community ecology of lizards; evolution of insect societies, behavioral ecology; population genetics and molecular systematics; genetic differentiation and evolution in structured populations; population genetics, cytoplasmically inherited reproductive incompatibility, evolutionary consequences of parasite-host interactions; regulation of reproduction in freshwater invertebrates; physiological energetics of insects; establishment of amphibian axiation and limb regeneration; mechanisms of growth control in amphibians; developmental genetics of juvenile hormone and oogenesis in *Drosophila;* cell biology of insect development; insect reproductive biology; identification of novel muscle proteins by means of biochemical and genetic approaches, how molecular interactions define mechanical properties of muscles; genetics of chemoreception and chemotactic behavior of protozoa; electrophysiological basis of swimming behavior; cellular basis of immunological response; molecular endocrinology, regulation of gene expression by estrogen.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE

An undergraduate major in zoology or its equivalent. Satisfactory scores on the Graduate Record Examination, general (aptitude) section. Acceptability to the faculty member with whom the candidate wishes to do thesis research.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF MASTER OF SCIENCE

Satisfactory completion of a qualifying examination.

MINIMUM DEGREE REQUIREMENTS

Zoology Graduate Colloquia, fours hours; 11 to 18 additional hours in zoology and related fields; thesis research (eight to 15 hours). Each candidate must participate in the teaching of at least one undergraduate course.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF ARTS IN TEACHING

The department offers a program leading to the degree of Master of Arts in Teaching (see page 20). Satisfactory scores on the Graduate Record Examination, general (aptitude) section, are requirements for acceptance for this degree.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF MASTER OF SCIENCE FOR TEACHERS (BIOLOGY)

A bachelor's degree from an accredited institution and certification as a teacher of biology or an associated field. At least three years of secondary school teaching. Satisfactory scores on the Graduate Record Examination, general (aptitude) section.

MINIMUM DEGREE REQUIREMENTS FOR THE M.S.T. (BIOLOGY)

Thirty hours of course work to include a selection of courses in the Departments of Botany and Zoology which will broaden and balance the undergraduate work in biology. At least two 200-level courses in each department. Courses in four of the five following areas: anatomy; morphology and systematics; genetics; developmental biology; and environmental biology. Up to 12 hours of 100-level courses may be used for the above requirements where approved by the advisor and the Dean. Appropriate courses in related science departments may be used to complete the required 30 hours. No thesis is required; however, each degree recipient must complete a written and oral examination.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDIES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Satisfactory completion of: college level courses appropriate for science majors including a year of mathematics, a year of physics, organic chemistry, at least one year of biology; the Graduate Record Examination, general (aptitude) section; and acceptability to the faculty member with whom the candidate wishes to do dissertation research. Deficiencies in prerequisites may be made up after entering the program.

REQUIREMENTS FOR ADVANCEMENT TO CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

The diagnostic examination prior to registration for the first semester; the comprehensive exam; minimum requirement course work of 30 hours and additional courses as required by the advisor and Studies Committee; at least one academic year of graduate study at The University of Vermont.

MINIMUM DEGREE REQUIREMENTS

Of the 75 credit hours required for the degree, at least 30 hours must be earned in courses suitable for graduate credit and must include six hours of Graduate Colloquia. The selection of courses will be designated for each student by his/her advisor and Studies Committee. At least 20, but not more than 45, credits must be earned in dissertation research. Each candidate must participate in the teaching of at least one undergraduate course.

COURSES OFFERED

Prerequisites for all courses: as listed, or equivalent, or by permission of instructor.

202 Quantitative Biology. Mathematical concepts applied to biological problems such as growth, metabolism, temperature effects, kinetics, and graphic interpretation of data. Statistics will not be treated. *Prerequisite:* An intermediate level course in biology, Math. 9, or permission of instructor. Three hours. Davison.

203 Population Ecology. (Biology 203.) Analysis of growth, regulation, and interrelations of biological populations in theoretical, laboratory, and natural systems. *Prerequisite:* Biology 102. Three hours. Schall. Alternate years, 1993-94.

205 Advanced Genetics Laboratory. Lecture/discussions alternated with laboratories to provide experiences with genetic techniques. Bench work and data analysis are emphasized. *Prerequisite:* Biology 101. Four hours. Van Houten.

208 Morphology and Evolution of Insects. Interrelationships, fossil history, comparative anatomy of major insect groups. Morphology and way of life of representatives of important insect orders and classes of arthropods. *Prerequisite:* 104 or Biology 102. Four hours. Bell. Alternate years, 1993-94.

209 Field Zoology. Collection, identification of invertebrates; September field work. Half of student's collection is general, identified to family; half is one or two groups identified to species. *Prerequisite:* 104 or Biology 102. Four hours. Bell.

212 Comparative Histology. Anatomy of tissues, chiefly vertebrate. Tissue similarities and specializations of organs among the various groups of animals in relation to function. *Prerequisite:* 104. Four hours. Landesman.

217 Mammalogy. Classification, identification, morphology, evolution, and distribution of mammals. *Prerequisite:* Biology 102. Four hours. Kilpatrick.

219 Comparative and Functional Vertebrate Anatomy. Structure, function, and phylogeny; evolutionary and functional trends; investigation of the structure of all chordate groups. *Prerequisite:* 104. Four hours. Kilpatrick. Alternate years, 1992-93.

223 Developmental Biology. An analysis of the cellular, subcellular, molecular, and genetic mechanisms that operate during oogenesis and embryogenesis in invertebrate and vertebrate organisms. *Prerequisites:* Biology 101, 103. Three hours. Landesman.

225 Physiological Ecology. Processes by which animals cope with moderate, changing, and extreme environments. *Prerequisites:* 104 and Biology 102. Three hours. Heinrich. Not offered 1992–93.

231 Cell Physiology. Selected topics of current research interest, including sensory transduction, information flow, oxygen transport, muscle performance, and other cellular processes. Emphasis on writing skills. *Prerequisites:* Biology 103; Chemistry 141, 142 and permission of instructor. Three hours. Otter. Alternate years, 1992-93

233 Cell Movement. Laboratory-oriented study of the fundamental principles of cell motility. Light microscopy of cell structure and movement. Biochemistry of molecules in the cytoskeleton. *Prerequisites:* Biol. 103; Chem. 141, 142; and permission of instructor. Four hours. Otter. Alternate years, 1993–94.

251 Insect Physiology. Anatomy and physiology emphasizing growth, reproduction, and sensory physiology. *Prerequisite:* 104 or permission of instructor. Four hours. Happ. Alternate years, 1993-94.

255 Comparative Reproductive Physiology. Various means by which animals reproduce. Special emphasis on the embryological origin and evolutionary relationships of sex cell differentiation. *Prerequisites:* 104; permission of instructor. Three hours. Davison.

263 Genetics of Cell Cycle Regulation. Molecular events during the cell cycle; mutants defective in cell cycling; comparison of normal and tranformed (cancer) cell cycling. *Prerequisite:* Biology 101 or permission of instructor. Three hours. VanHouten. Alternate years, 1993–94.

265 Developmental Molecular Genetics. Current topics in developmental genetics explored through lectures and discussions of current literature; emphasis on molecular approaches. *Prerequisite:* Biology 101. Three hours. Van Houten. Alternate years, 1992–93.

270 Speciation and Phylogeny. Contributions of modern research in such fields as genetics, systematics, distribution, and serology to problems of evolutionary change. *Prerequisite:* Biology 101 (102 recommended). Three hours. Kilpatrick. Alternate years, 1993-94.

281 Seminar. Review and discussion of current zoological research. Attendance required of Zoology graduate students. Seniors in zoological research programs are expected to enroll. Without credit.

295, 296 Special Topics.

371 Graduate Colloquia. Topics of current faculty and graduate student interest presented in a seminar-discussion format. Specific titles for colloquia will be listed in the course schedule. One hour.

381 Special Topics. Readings with conferences, small seminar groups, or laboratories intended to contribute to the programs of graduate students in phases of zoology for which formal courses are not available. *Prerequisite:* An undergraduate major in zoology. Credit as arranged.

391 Master's Thesis Research. Credit as arranged.

491 Doctoral Dissertation Research. Credit as arranged.

Courses of Instruction for Graduate Credit

The following courses are offered for graduate credit by departments and programs that do not offer a graduate degree program. Some of the courses below may be appropriate to satisfy a portion of the course requirements for a specific graduate degree program listed earlier.

ANTHROPOLOGY (ANTH)

200 Field Work in Archaeology. Methods and techniques of archaeological investigation in field situations and laboratory analysis of data. *Prerequisites:* 24, one 100-level course in anthropology or by permission of instructor. Six hours. Summers only.

210 Archaeological Theory. Development of archaeology from the 18th century to the present, including concepts of form, space and time, intellectual attitudes, current systems theory, and research strategies. *Prerequisites:* 24, one 100-level anthropology course; or Historic Preservation 201; or by permission of instructor. Three hours. Power. Alternate years.

225 Anthropological Theory. Schools of anthropological thought in relation to data on non-Western societies and the historical and social context in which the anthropologist works. *Prerequisites:* 21, one 100-level course or by permission of instructor. Three hours. C. Lewin, Mitchell.

228 Social Organization. Examination of the basic anthropological concepts and theories used in the cross-cultural analysis of kinship and marriage. *Prerequisites:* 21, one 100-level course or by permission of instructor. Three hours. C. Lewin, Mitchell.

278 Microethnography. Tape recorders and video cameras used to explore human patterns of communication; specifically phonemic, paralinguistic, haptic, and kinesic detail, as well as ethnographic semantics. *Prerequisite:* 28, or Linguistics 101 or by permission of instructor. Three hours. Woolfson.

283 Culture Change. Study of sociocultural transformations in non-Western countries. *Prerequisites:* 21, one 100-level course, or 21, six hours in the social sciences or by permission of instructor. Three hours. Gordon. Alternate years.

290 Methods of Ethnographic Field Work. Examination of theoretical and ethical premises of field work methodology with practical experience in participant observation, interviewing, the genealogical method, and recording of data. *Prerequisite:* Twelve hours of anthropology or by permission of instructor. Three hours. Mitchell. Alternate years.

295, 296 Advanced Special Topics. *Prerequisites:* 21, one 100-level course or by permission of instructor.

297, 298 Advanced Readings and Research. *Prerequisite:* By permission of instructor. Variable, one to three hours.

ART (ART)

201 Architecture, Landscape, and History. See Historic Preservation 201. Three hours. Liebs.

207 Seminar in American Architecture and Design. Selected topics in American art and/or architecture, individual research and reports. *Prerequisites:* By permission to advanced students in art history, architectural studies, or historic preservation. Three hours. Janson.

282 Seminar in Western Art. Selected topics in Western Art. See Schedule of Courses for specific offerings each semester. *Prerequisites:* Six hours of intermediate level Art History courses, including three hours in the area of the seminar, or equivalent. Three hours.

295 Advanced Special Topics in Studio Art. Advanced work in existing departmental offerings at the 100 and 200 levels. *Prerequisite:* Instructor permission. Three hours.

EDUCATION-EARLY CHILDHOOD AND HUMAN DEVELOPMENT (ECHD)

260 Family Ecosystem. The family will be viewed in and as an environment for human development. The family ecological approach will be applied to practical family concerns. *Prerequisite:* Permission of instructor. Three hours.

263 Advanced Child Development. A survey of the professional literature in child development with special emphasis on the influence of early life experiences throughout the life cycle. *Prerequisite:* 80-81 or equivalent. Three hours.

264 Contemporary Issues in Parenting. Contemporary cultural factors that influence adult lifestyles and their relationship to successful parenting. *Prerequisite:* Nine hours in human development or permission of instructor. Three hours.

265 Teaching Human Development. Seminar designed for individuals who teach or plan to teach human development. Emphasis on group-building skills and interpersonal relationships. *Prerequisites:* Six hours in human development and permission of instructor. Three hours.

266 Seminar in Human Development. Intensive study of issues in human development and their application in a wide variety of professional areas. May be taken more than once up to a maximum of 12 credits. *Prerequisites:* Nine hours of human development or equivalent. Three hours.

281 Infancy. Development and rearing from conception to 18 months old and their relationship to subsequent development. *Prerequisites:* Nine hours in human development, nutrition, and physiology or biology or permission of instructor. Three hours.

282 Seminar in Physical Development and Health in Later Life. Physical manifestations of senescence, anatomical and physiological development, longevity, vitality, health care, nutrition, chronic conditions, and disability. *Prerequisite:* 181 or permission. Three hours.

283 Personal and Family Development in Later Life. Cognitive development, intellectual performance, work and achievement, retirement and leisure, personal development, self-esteem, coping mechanisms, dying, couples, intergenerational and kinship issues. *Prerequisite:* 181 or permission. Three hours.

284 Public Policy and Programs for Elders. Demography of aging, social institutions and roles, policy and program implementation, income maintenance, housing, health care, social services, transportation, legal and political issues. *Prerequisite:* 181 or permission. Three hours.

291 Special Problems. Reading, discussion, and special field and/or laboratory investigations. *Prerequisite:* Departmental permission. Students may enroll more than once for a maximum of 12 hours. One to six hours.

295 Special Topics. Lectures, laboratories, readings, or projects relating to contemporary areas of study. Enrollment may be more than once; accumulate up to 12 hours. *Prerequisite:* Departmental permission.

296 Field Experience. Professionally oriented field experience under joint supervision by faculty and business or community representative. Credit arranged up to 15 hours. *Prerequisite:* Departmental permission.

ENVIRONMENTAL STUDIES (ENVS)

291 Special Topics. Credit as arranged.

293 Environmental Law. Principles of environmental law, including legal research, methods, threshold issues, case law, trial procedure, and international comparisons in aspects of air, land, and water law. *Prerequisite:* Permission of instructor. Three hours. Richardson.

294 Environmental Education. Philosophy, principles and concepts, and strategies of environmental education, with emphasis on integrating environmental concerns into formal and nonformal educational programs for youth and adults. *Prerequisites:* At least six hours of intermediate or advanced level courses in environmental studies, natural resources, or related areas. Three hours. Hudspeth.

295 Advanced Seminar. Credit as arranged.

GRADUATE COLLEGE (GRAD)

385 Master's Language Examination. Required for all master's degree students during semester in which examination will be completed. Zero hours. Code 0928.

395 Special Topics. Workshop in the Social Sciences.

397 Master's Comprehensive Examination. Required for all master's degree students during semester in which comprehensive will be completed. Zero hours. Code 0929.

399 Thesis Defense. Required for all master's degree candidates during semester in which defense is scheduled. Zero hours. Code 0930.

485 Doctoral Language Examination. Required for all doctoral degree students during semester in which examination will be completed. Zero hours. Code 0931.

497 Doctoral Comprehensive Examination. Required for all doctoral degree students during semester in which comprehensive will be completed. Zero hours. Code 0932.

499 Dissertation Defense. Required for all doctoral degree candidates during semester in which defense is scheduled. Zero hours. Code 0933.

900 Continuous Registration Fee. All graduate students who have enrolled for all credits required in their degree program but who have **not completed all degree requirements** (e.g. comprehensive exam, defense of project or thesis) must pay a $100 fee per Fall and Spring semester. Zero hours. Code 0900.

HUMANITIES (HUMN)

300 Modern Literary Theory. A survey of modern literary theory, including Slavic and Anglo-American formalism, marxism, feminism, structuralism, hermeneutics, deconstruction, and new historicism. *Prerequisites:* Graduate standing at UVM, or an A.B. in some humanities discipline and permission of the instructor. Three hours. Staff. Alternate years.

301 Humanities Graduate Seminar. Varying interdisciplinary topics for humanities graduate students. *Prerequisites:* Graduate standing at UVM, or an A.B. in some humanities discipline and permission of the instructor. Three hours. Staff.

INTERNATIONAL STUDIES (IS)

297, 298 Seminar. Seminar for international studies majors and other qualified students conducted by a team of area specialists and covering selected topics through interdisciplinary and comparative approaches. *Prerequisite:* Permission by the executive committee of International Studies. Three hours.

MERCHANDISING, CONSUMER STUDIES, AND DESIGN (MCSD)

223 Functional Apparel Design. Analysis and evaluation of the social and physical apparel needs of a variety of consumer groups; activities include discussion, experimentation, and design. *Prerequisite:* 122 or permission of instructor. Three hours. Loker.

261 Consumer Education Seminar. Survey and analysis of programs, materials, and research in consumer information and education. *Prerequisite:* A research methodology course or six credits undergraduate course work in consumer studies. Three hours.

295 Special Topics. Lectures, laboratories, directed readings, and projects on advanced topics as announced. *Prerequisite:* Departmental permission. Credit as arranged.

MUSIC (MUS)

211,212,213,214,215 Seminars in Music Literature. Seminars will treat in detail topics surveyed in the intermediate level music literature sequence. Subject matter will be determined by the instructor. *Prerequisites:* 11, 12; 111 for 211; 112 for 212; 113 for 213; 114 for 214; 115 for 215. Three hours. Offered on irregular basis as required by major enrollment. Ambrose, Chapman.

216 Bibliography Seminar. Biographies and critical works, bibliographies, Festschriften, scholarly and performing editions of music and discography will be surveyed. *Prerequisites:* Music 11, 12, one additional music literature course at the 100 or 200 level. Three hours. Ambrose, Chapman.

231, 232 Advanced Theory. Advanced countepoint and harmony; analysis of form in music. *Prerequisites:* 132, 134; 231 for 232 or consent of instructor. Three hours. Read, Wigness.

233 Arranging. Characteristics of instruments; arranging for ensembles. *Prerequisite:* 231 or consent of instructor. Three hours. Brown, Wigness.

234 Orchestration. Studies in orchestral scoring. *Prerequisite:* 233 or consent of instructor. Three hours. Brown, Wigness.

235 Fugal Composition. Study of representative baroque, classical, and contemporary fugal procedures through analysis and composition. *Prerequisite:* 231 or consent of instructor. Three hours. Chapman, Read.

237, 238 Composition. Creative work in free composition with instruction according to the needs and capabilities of the individual student. *Prerequisites:* 232, 235 or consent of instructor. Three hours. Read.

240 Seminar in Musical Analysis. Advanced study of musical forms. Comparison of standard approaches to harmonic, motivic, and rhythmic analysis. *Prerequisites:* 232, 235 or consent of instructor. Three hours. Read, Wigness.

259 Conducting. Baton technique, score reading, laboratory practice; preparation and performance of selected scores, including score reading at the piano and rehearsal procedures. *Prerequisites:* 132, 134 or equivalent. Three hours.

265 Vermont Wind Ensemble. Study and performance of masterworks for wind ensemble and concert band. Attendance at all rehearsals and concerts required. *Prerequisite:* Audition. One hour. May be repeated for credit. Nelson.

281 Kodaly Institute. Study/application for Kodaly's music education philosophy for children through grade 8. Presentation of folk traditions, solfege, methodology, curriculum; improvisation; children's choirs, conducting, art-music. *Prerequisites:* B.S. in Music Education or equivalent.

Cross-listing: EDMU 243. Three hours for two-week course (for Certificate holders) *or* six hours for three-week course (for study and application of Kodaly's principles and music education).

297, 298 Advanced Readings and Research. Studies in composition or related special topic under the direction of assigned staff member. *Prerequisite:* Consent of instructor. Credit as arranged.

OBSTETRICS AND GYNECOLOGY (OBGY)

295 Special Topics. Lectures, readings, or laboratory investigations for advanced students within areas of expertise of faculty and staff. *Prerequisite:* Permission of instructor. Credit as arranged.

(Human reproduction: A discussion-oriented course for advanced students in reproductive biology. Primary focus on the physiology and endocrinology of human reproduction and pregnancy, including critical evaluation of current technology and bioethical issues. Four hours. Auletta, Osol. Spring, alternate years.)

ORTHOPAEDIC SURGERY (ORTH)

291, 292 Research in Orthopaedics and Rehabilitation. Work on research problem under the direction of a faculty member. Review of literature, preparation of manuscript. *Prerequisite:* Departmental permission. Three hours. Beynnon, Pope, Stokes, Wilder (in collaboration with clinical faculty of the Department).

381,382,383,394 Readings and Research in Musculoskeletal Biomechanics. Intended for Graduate Students doing thesis or dissertation work in Biomechanis. Class will meet to discuss current journal articles and literature reviews prepared by students. *Prerequisite:* Approval of instructor(s). One hour each. Pope, Stokes, Wilder.

PHILOSOPHY (PHIL)

Prerequisites for all courses: as listed, or equivalent, or by permission of instructor.

201 Theory of Knowledge. A critical examination of the nature and sources of knowledge: belief, truth, evidence, perception, memory, and induction. *Prerequisite:* 102 or 112. Three hours. Kornblith.

202 Metaphysics. A critical examination of such topics as the nature of space and time, the concept of change, the identify of the self, the nature of the world and our place in it. *Prerequisite:* 101, 102, or 110. Three hours. Christensen, Kornblith, Mann.

210 Philosophy of Mind. Major philosophical theories of the mind and its relation to the physical world, the nature of sensation, desire, and belief, and the relation between thought and action. *Prerequisite:* 102 or 110. Three hours. Kornblith, Pereboom.

212 Philosophy of Science. A thorough investigation of one or two problems in the philosophy of science. Emphasis on modern attempts to solve them. *Prerequisite:* 112 or any 100-level history of science course. Three hours. Christensen.

217 Philosophy of Language. A philosophical study of the nature of language. *Prerequisite:* 113 or Linguistics 100, 102. Three hours. Christensen, Hansen, Kornblith.

221 Topics in Chinese Philosophy. A detailed examination of a classical Chinese philosophical text or school. *Prerequisite:* 121 or 122. Three hours. Hansen, Van Norden.

240 Contemporary Ethical Theory. An analysis of the ideas of contemporary moral philosophers in normative ethics and metaethics. *Prerequisites:* 140, 142, 143 or 144. Three hours. Kuflik, Loeb.

241 Contemporary Social and Political Philosophy. An analysis of the ideas of contemporary philosophers in social and political philosophy. *Prerequisites:* 140, 142, 143, or 144. Three hours. Kuflik, Loeb.

242 Justice and Equality. (Same as Political Science 241.) An examination of contemporary normative theories of distributive justice and equality. *Prerequisites:* 140, 142, 143, or 144. Three hours. Kuflik, Loeb; Wertheimer (Political Science).

260 Topics in Continental Philosophy. Study of a central issue in current continental philosophy, e.g. social theory, psychoanalysis, or aesthetics. Readings from Nietzsche, Heidegger, Gadamer, Ricoeur, Habermas, Derrida, and Foucault. *Prerequisites:* 107 or 160. Three hours. May be repeated when topic is different. Guignon.

262 Existentialism. A study of existentialism as a philosophy, and an examination of its background, as displayed in the literary and philosophical writings of Pascal, Kierkegaard, Camus, Heidegger, and Sartre. *Prerequisites:* Any two of 101, 102, 107. Three hours. Guignon, Hall.

265 American Philosophy. The thought of such leading American philosophers as Peirce, James, Royce, Santayana, Dewey, and Whitehead. *Prerequisites:* 101, 102. Three hours. Miller.

271, 272 Seminar: Major Philosophical Author or School. A study of the major philosophical texts by a single author or school of thought. May be repeated for credit when different authors are studied. *Prerequisite:* An appropriate 100-level course in philosophy. Three hours.

295, 296 Advanced Special Topics. Advanced courses or seminars on topics beyond the scope of existing departmental offerings.

297, 298 Readings and Research. Independent study with an instructor on a specific philosopher or philosophical problem. *Prerequisite:* An appropriate 200-level course in philosophy.

RELIGION (REL)

291, 292 Topics in the History and Phenomenology of Religion. *Prerequisites:* Nine hours in religion; or permission of instructor. Three hours.

SOCIOLOGY (SOC)

Courses numbered 200 to 299 require a minimum of **six hours of sociology,** three of which must be at the 100 or intermediate level, equivalent preparation as indicated or permission of the instructor.

202 Population Dynamics. Analysis of factors affecting human population growth, distribution; migration patterns; relationship between economic activity and population trends. *Prerequisites:* Six hours of sociology, or Sociology 1 and an introductory course in biology, economics, geography, or zoology or equivalent. Three hours. McCann, Tang.

204 Ecological Perspective on Human Communities. Analysis of relationships between social, economic, technological organization of communities and their physical and sociocultural environments. Emphasis upon community land use, settlement patterns. *Prerequisite:* Six hours of sociology or Anthropology/Geography 179 or equivalent. Three hours. Schmidt.

205 Rural Communities in Modern Society. Changing structure, dynamics of rural social organization in context of modernization and urbanization. Emphasis on rural communities in U.S. Three hours. Diouf, Schmidt, Smith.

206 Urban Communities in Modern Society. Changing structure, dynamics of urban social organization in context of modernization and urbanization. Emphasis on cities, metropolitan areas in U.S. Three hours. Loewen, Sampson.

207 Community Organization and Development. Communities as changing sociocultural organizational complexes within modern society. Problems of formulation, implementation of alternative change strategies. Three hours. Diouf, Finney, Schmidt.

209 Small Groups. Structure and dynamics of small groups and the interpersonal, informal network of relations that characterize interaction of members. Three hours. Kahn.

211 Social Movements and Collective Behavior. Examination of origins, development, structure, consequences of crowds, riots, crazes, rumors, panics. Political, religious movements and their relationships to cultural, social change. Three hours. Berkowitz, Danigelis, Diouf, Schmidt.

213 Women in Development in Third World Countries. An examination of the meaning and measurement of development, socio-demographic characteristics, sex stratification and effects of Colonialism and Westernization on women's issues in the Third World. Three hours. Diouf, Kahn, McCann, Smith.

214 Delinquency. Analysis of nature, types of juvenile behavior that violates law. Mechanisms for defining such behavior as delinquent, their causes and consequences. Three hours. Fishman, Stanfield.

216 Criminal Justice. Analysis of social structures, processes involved in identification, labeling of individuals as criminal offenders: criminal law, its enforcement and the courts. Three hours. Fishman, McCann, Stanfield.

217 Corrections. Analysis of social structures, processes involved with individuals designated as offenders of criminal law; probation, prison, parole, programs of prevention, rehabilitation. Three hours. Fishman, Stanfield.

219 Race Relations. Examination of American racial subordination in social, historical perspective. Analysis of interracial contacts, racial subcultures, social structures. Responses to racial prejudice, discrimination. Three hours. Danigelis, Diouf, Loewen, Tang.

221 Aging and Social Change. Examines effects of social change on older persons and on the aging process. Also analyzes how a growing older population leads to social change. Three hours. Cutler.

222 Aging and Ethical Issues. Analysis of selected ethical issues posed by an aging society and faced by older persons, their families, health care and service providers, and researchers. Three hours. Cutler.

225 Organizations in Modern Society. Examination of basic classical and contemporary theory, research on human relations, internal structures, environments, types, general properties of complex organizations, bureaucracies. Three hours. Berkowitz, Finney, Mintz, Sampson.

228 Organizational Development and Change. Examination of basic, applied research on problems of organizational effectiveness, innovation. Presentation of organizational development, change techniques, practical class exercises. *Prerequisite:* Six hours of sociology, or one college course on organizations, or equivalent organizational experience with permission of instructor. Three hours. Berkowitz, Diouf, Finney, Mintz.

229 The Family as a Social Institution. The institution of the American family in cross-cultural, historical perspective. Theories, research on family continuity, change, institutional relationships. *Prerequisite:* 129 or six hours of sociology or equivalent. Three hours. Fengler, Kahn, Smith.

232 Social Class and Mobility. Comparative, historical analysis of causes, forms, consequences of structured social inequality in societies. Selected problems in contemporary stratification theory, research. Three hours. Danigelis, Diouf, Finney, Krymkowski, McCann, Mintz, Sampson, Schmidt, Smith, Tang.

237 Occupations and Professions. Analysis of social organization of economic roles in industrial societies, institutional relations of occupations, professions, impact of work structure on the individual. Three hours. Finney, Mintz, Smith, Tang.

239 Women and Public Policy in Vermont. A detailed analysis of the social processes involved in public policy formation in Vermont and the consequences for women. Three hours. Smith.

240 Political Sociology. Social organization of power, authority in modern societies and dynamics, institutional relationships of political institutions, interest groups, parties, publics. Three hours. Berkowitz, Danigelis, Diouf, Loewen, Mintz.

241 Methods of Public Opinion Research. (Same as Political Science 284.) Methods in conducting public opinion research: design, sampling, questionnaire construction, administration, data control, analysis of cross-sectional, longitudinal, and time series data. *Prerequisite:* 100 (Political Science 181) or equivalent with permission of instructor. Three hours. Berkowitz, Danigelis.

242 Public Opinion: Theory and Research. (Same as Political Science 285.) Theories of public opinion. Topics: attitude formation and change, political ideology, alienation and allegiance, political socialization, tolerance, political extremism. *Prerequisite:* 241 (Political Science 284) or permission of instructor. Three hours. Sampson.

243 Mass Media in Modern Society. Intensive examination of selected topics in the structure of media organizations and their relationships to and impacts upon the major institutions and publics of contemporary society. Three hours. Streeter.

250 The Sociology of Culture. Analyzes the relationship of cultural forms and subjective experience to social structure and power; in-depth applications of interpretive approaches in contemporary sociology. Three hours. Kahn, Streeter.

254 Sociology of Health and Medicine. Social organization, institutional relationships of medicine in society. Role of sociocultural factors in etiology, definition, identification, treatment of illness. Three hours. Berkowitz, Kahn, Mintz.

255 Sociology of Mental Health. Analysis of social structures, processes involved in identification, definition, treatment of mental illness and its sociocultural etiology, consequences. Three hours.

258 Sociology of Law. Analysis of socio-cultural structure of legal institution and its relationships to other institutions: social organization of legal profession, lawmaking, courts. Three hours. Stanfield.

274 Research Seminar. Principles of research design, data gathering, ethics, measurement, data analysis, and data presentation. Student will complete a research project. *Prerequisite:* 100 or equivalent with permission of instructor. Danigelis, Finney, Krymkowski, Loewen, Schmidt, Tang.

275 Methods of Data Analysis in Social Research. Quantitative analysis of sociological data. Table, regression, path analysis, scaling and factor analysis, analysis of variance (emphasis on multivariate techniques). *Prerequisites:* Sociology 100 or equivalent with permission of instructor. Three hours. Berkowitz, Danigelis, Krymkowski, McCann, Tang.

279 Contemporary Sociological Theory. Critical examina-

tion of contemporary functional, conflict, exchange, interactionist, structural theoretical approaches. Other theoretical approaches selected by seminar participants. *Prerequisite:* Sociology 178 or instructor permission. Three hours. McCann, Sampson.

281, 282 Seminar. Presentation, discussion of advanced problems in sociological analysis. *Prerequisites:* Twelve hours of sociology, permission of instructor. Three hours.

288, 289 Seminar: Research and Methods of Teaching Sociology. Development, evaluation of teaching sociology. *Prerequisites:* Twelve hours of sociology, permission of department. Open only to graduate students and advanced undergraduate sociology students who serve concurrently as teaching assistants in the department. Three hours.

295, 296 Special Topics.

297, 298 Readings and Research.

SPANISH (SPAN)

SPANISH LITERATURE

235 Golden Age Drama and Prose. The picaresque novel and the drama of the 16th and 17th centuries, emphasizing Lope de Vega, Calderon, Quevedo, Tirso De Molina. Three hours. Weiger.

236 Golden Age Poetry. The major poets (Carcilaso, Fray Luis, San Juan, Quevedo and Gongora) and the poetic tradition of the 16th and 17th centuries. Three hours. Wesseling.

245, 246 Cervantes. *Don Quijote,* the *Novelas Ejemplares,* and the theatre of Cervantes. Three hours each course. Weiger.

265 19th Century Spanish Literature. Romanticism and realism: (1.) Romantic theatre, prose, poetry; (2.) the realist and naturalist novelists: Galdos and Leopoldo Alas. Three hours. Wesseling.

276 20th Century Spanish Poetry and Drama. Vanguard vs. tradition from the "Generation of 1898" to the present. Three hours. Roof, Wesseling.

277 20th Century Spanish Prose Fiction and Essay. Innovation and experimentation from the Generation of 1898 to the present. Three hours. Roof, P. Wesseling.

281 Spanish-American Prose Fiction of the 20th Century. A study of representative works by major authors tracing the development of narrative forms from their roots in the last century to the present. Three hours. Murad.

285, 286 Spanish-American Literature of Social Protest. Literature of Spanish-American peoples as a reflection of, contribution to social problems following various directions of social protest against political systems, governments, imperialism. 286 stresses the contemporary. Three hours each course. Zarate.

291 Civilization of Spain. Topical approach to the study of Spanish civilization through the 17th century, emphasizing ideas, art and literature. Three hours. Maura.

292 Civilization of Spain. Topical approach to the study of Spanish civilization from the 18th century to the present, emphasizing ideas, art and literature. Three hours. Roof.

293 Latin American Civilization. History, culture of Latin American people from formation of Indian civilization to present ideals, problems. Pre-Hispanic civilization, colonization, modern states. Artistic, literary, musical manifestations of those periods. Three hours. Zarate.

295, 296 Advanced Special Topics.

297, 298 Advanced Readings.

WOMEN'S STUDIES (WST)

295, 296 Advanced Special Topics. Advanced courses or seminars on women's studies. *Prerequisite:* Permission of instructor. Three hours. Staff.

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Index

NOTES

NOTES

NOTES

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