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VOL. XXXVII

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No. 11

*BULLETIN*  
*of the*  
*UNIVERSITY OF*  
*NEW HAMPSHIRE*



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# BULLETIN of the University of New Hampshire

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## THE UNIVERSITY BULLETIN INCLUDES:

The Catalogue Issue of the University

The Report of the President Issue

The Financial Report Issue

The Catalogue Issue of the Summer Session

The Catalogue Issue of the Graduate School

*and other publications of the University of New Hampshire*

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# The Graduate School

## RULES AND REGULATIONS

**OBJECTIVES:** The Graduate School is designed to meet the needs of superior students for training beyond their undergraduate work. Graduate work is offered by competent members of the University Departments of instruction and research. Administrative functions and supervision of advanced students are delegated to the Dean of the Graduate School and the Executive Council.

The Graduate work of students in Education is designed to supplement their undergraduate studies in such manner as to prepare them most effectively for the professions of elementary- and secondary-school teaching, and of public-school administration and supervision.

Graduate Students are defined as those who meet the requirements for admission to the Graduate School (*see Rules and Regulations under Admission*), and are registered for *more than half their program for graduate credit*.

**ADMISSION:** Admission to the Graduate School may be granted to graduates of all colleges and universities of approved standing, provided their undergraduate records are satisfactory. Before entering upon graduate work the applicant must present evidence to the effect that he has had the necessary prerequisite training that will enable him to pursue with profit the courses desired. A candidate for admission who intends to work for a Master's Degree must have had an undergraduate average of not less than 2½ honor points, or the equivalent, throughout his entire program of study. Upon petition to the Executive Council, this requirement may be waived in the case of a mature college graduate who gives evidence of adequate professional experience or advanced study since graduation from an undergraduate program. Admission to the Graduate School does not imply admission to candidacy for the degree. A candidate for admission who does not intend to be a candidate for a degree may enroll in the Graduate School for any course for which he has had sufficient preparation. No graduate student is admitted to candidacy for degree until he has been in residence a sufficient time to enable his instructors to judge of his ability to carry on graduate work. Generally, this period of time shall be not less than one semester or two summer sessions. Admission to candidacy for a degree will be determined by the Executive Council.

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**REGISTRATION:** A student desiring to register for graduate study must submit to the Dean of the Graduate School the official application for admission to Graduate study. Blanks for this purpose may be obtained from the Dean's Office. A student's program of courses must be approved by his adviser and the Dean.

**TUITION\*:** The tuition fee is \$160 a year for residents of New Hampshire, and \$360 a year for non-residents.

Any student registering for 8 credits or more shall pay the full semester tuition. Any student registering for less than 8 credits shall pay \$6.00 per credit hour, if a resident, and \$13.00, if a non-resident. A Graduate Assistant registering for less than 9 credits shall pay \$3.00 per credit hour, and if registered for more than 9 credits shall pay \$80 per year.

**REQUIREMENTS FOR MASTER'S DEGREE:** The Graduate School will grant degrees as follows: Master of Arts, Master of Science, and Master of Education.

For the degrees in Arts and in Science, 30 semester credits must be earned. Of these, at least 18 must be taken in courses offered by the major department, and any major department may prescribe for its own students the subjects in which the remaining credits are to be earned.

For the degree of Master of Education see departmental statement.

**RESIDENCE:** A minimum of one full academic year, or five summer sessions of six weeks each will be required of all candidates for the Master's Degree. If the work is taken in the regular academic year, no exception to this residence requirement will be permitted.

If the work is taken in Summer Sessions in the University of New Hampshire, the following variations are permissible: The time occupied in earning 6 credits elsewhere in an approved graduate school may be accepted in lieu of one summer session of residence. These regulations make it possible to complete the residence requirements in four summer sessions.

If the candidate offers acceptable credits earned at this University in Saturday courses, or in extra-mural courses, two semester courses of such work will be counted as the equivalent of one summer session in residence.

**EXAMINATIONS:** Any department may demand a final oral or written examination of its candidates for the Master's Degree; but the details of the departments' requirements in this matter must be approved by the Executive Council.

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\*For tuition rates in Summer Session see Summer Session bulletin.



## GRADUATE SCHOOL

**GRADES:** The passing grade in the Graduate School is C. Candidates for a degree must earn a grade of B or better in three-fourths of the work for which a letter grade is given.

All graduate work, for any degree, must be completed in not more than eight years.

**GRADUATE CREDITS:** Graduate credits may be earned in the University of New Hampshire, only in courses numbered 51 to 199, but graduate credits will not be given in any courses so numbered which admit Freshmen or Sophomores.

For any Master's Degree except that of Ed.M., the candidate must earn not less than 12 semester credits in the courses primarily for graduate students (numbered 101-199 or thesis) and not more than 10 semester credits in courses outside of those offered by his "major" department.

**GRADUATE CREDIT FOR SENIOR STUDENTS:** Senior students in the University of New Hampshire must register in the Graduate School for any work for which they may subsequently apply for graduate credit.

**TRANSFER CREDITS:** A candidate for any Master's Degree may present for credit a maximum of 6 credits earned elsewhere at an approved graduate school.

**THESIS:** A thesis will be required of all candidates for the Master's Degree in Arts and in Science and may be submitted by the candidates for the Master's Degree in Education. The thesis, when submitted, must be approved by a committee of two, including the instructor under whose direction the paper has been written, and another member selected jointly by the Head of the Department and the Dean of the Graduate School. The Executive Council will determine the regulations under which the thesis is to be submitted. The candidate must file with the Executive Council, for its approval, a statement of the subject not later than six months prior to the date of the conferring of the degree. No credit shall be given until the completed thesis has been approved.

**THESIS CREDITS:** The number of thesis credits may vary from 6 to 10, subject to the approval of the major department.

**THESIS REGULATIONS:** All thesis must be typewritten upon standard paper, 8½ x 11 inches, medium weight. The title page should bear the following statement:

*A thesis submitted to the University of New Hampshire in partial fulfillment of the requirements for the Degree of*

*Master of Arts*

*Master of Science*

*Master of Education*

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Whenever a thesis is printed, it must, if possible, be designated as having been accepted as a Master's Thesis by the University of New Hampshire.

Two copies of the approved thesis, ready for binding, and an approved abstract of not more than 750 words shall be turned in to the Graduate School Office not less than five days before Commencement, together with receipt for binding fee from the Treasurer's Office.

**SPECIAL REQUIREMENTS:** The student must meet the special requirements of his major department and his program must be approved by his adviser, who will be designated by the Dean.

**HONORARY FELLOWSHIPS FOR VISITING SCHOLARS:** Properly qualified scholars, who may desire temporarily the privileges of the library and research facilities of the University, and who are not candidates for a degree may, upon recommendation of the Dean of the Graduate School and the approval of the President of the University, be appointed Honorary Fellows without stipend. Honorary Fellows shall not be required to pay any charges except, possibly, the cost of unusually expensive supplies or equipment.

**ASSISTANTSHIPS AND SCHOLARSHIPS:** Graduate Students may be employed as Graduate Assistants for (a) Research, (b) Teaching, and (c) Service, at \$50, \$70, and \$90 per month, depending upon the student's program of hours of study and hours of service. Inquiries regarding Assistantships should be addressed to the Head of the Department concerned.

A limited number of superior students are awarded exemption from tuition. These awards are subject to the maintenance of a high scholarship record in the Graduate School and may be revoked at the end of any semester if the student does not merit such exemption for the subsequent semester.

Candidates for tuition scholarships are required to take the Graduate Record Examination. Inquiries in regard to this examination may be made at the Office of the Dean of Student Administration, University of New Hampshire, Durham, N. H., or the Graduate Record Office, 437 West 59th Street, New York (19), N. Y.

The candidates for tuition scholarships must fill out an application form which is available from the Dean of the Graduate School.

**SPECIAL REGULATIONS FOR VETERANS:** Men and women released from the Armed Forces will be permitted to transfer not more than 12 of the 30 credits required for a degree under the following conditions:

1. The credits must be transferred from approved graduate schools or other approved official agencies.

## GRADUATE SCHOOL

2. In each case, transferred credits will be accepted and evaluated by a committee consisting of the Dean of the Graduate School, the Dean of Student Administration, and the Chairman of the Division concerned.

3. The remaining credits must be earned in residence.

**SUPPLIES:** Books, drawing instruments, and instructional materials may be purchased at the University Bookstore in Thompson Hall.

**ROOMS:** Because of the congestion of undergraduate students in the dormitories of the University, it is impossible to guarantee reservation of rooms to graduate students. Rooms may be secured in private houses at \$85 to \$150 a year.

**BOARD:** The University operates on a self-service basis a modern, well-appointed dining hall. Regular weekly board and cafeteria service are provided. Savings made possible by reduced costs of operation are passed along to the students in the form of reduced board charges.

## Descriptions of Courses

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

### AGRICULTURAL AND BIOLOGICAL CHEMISTRY

THOMAS G. PHILLIPS, *In Charge*

Students majoring in this Department are expected to have had preparation in the Biological Sciences, in Mathematics, in Physics, and in General, Analytic, and Organic Chemistry.

51-52. **PHYSIOLOGICAL CHEMISTRY.** The chemistry of fats, carbohydrates, and proteins; colloids, enzyme action, digestion, metabolism, and excretion. The qualitative and quantitative examination of blood and urine. Mr. Shimer, Mr. Teeri. Prereq.: Satisfactory preparation in Organic Chemistry and Quantitative Analysis. 3 lec.; 2 lab.; 5 cr.

53-54. **AGRICULTURAL ANALYSIS.** A study of the methods of analysis of soils, fertilizers, feeding stuffs, and other products important in Agriculture. Mr. Phillips, Mr. Shimer. Prereq.: Satisfactory preparation in Organic Chemistry and Quantitative Analysis. 1 lec.; 3 lab.; 4 cr. (Given in alternate years; offered in 1946-1947.)

101-102. **ADVANCED BIOCHEMISTRY.** The preparation, composition, and analysis of carbohydrates, fats, and proteins. Discussions and laboratory. Mr. Phillips and Mr. Shimer. Prereq.: Satisfactory preparation in Analytical, Organic, and Biological Chemistry. 4 cr.

103-104. **SPECIAL PROBLEMS.** Conferences, and library and laboratory work on special phases of Chemistry in its relation to Agriculture and Biology. Mr. Phillips, Mr. Shimer, Miss Purington, Mr. Teeri. Prereq.: Satisfactory preparation in Analytical, Organic, and Biological Chemistry. Subject matter and credits to be arranged.

### AGRICULTURAL ECONOMICS

HARRY C. WOODWORTH, *In Charge*

Admission as a major in Agricultural Economics may be granted those who have satisfied the requirements for admission to the Graduate School and present evidence of satisfactory training in the fields of Agriculture and Economics. Normally, this will mean a degree from a college of agriculture and 9 or more credits in Economics, in-

## GRADUATE SCHOOL

cluding Agricultural Economics, as evidence of aptitude for advanced training in the field of Agricultural Economics. The requirement of a degree from a college of agriculture may be waived in the case of a mature student who has a degree in a field other than Agriculture, (providing he presents evidence of an intimate knowledge of farm production and marketing practices), upon approval of the Head of the Department.

52. CO-OPERATIVE BUSINESS: Stress is placed on the organizational, legal, and financial problems of farmers' business corporations engaged in buying and selling. Selected problems of general agricultural marketing are integrated with the course content. Mr. Grinnell. (Formerly given as Agr. Econ. 15.) Elective for Juniors and Seniors, 3 lec.; 3 cr.

53. AGRICULTURAL PRICES: Quantity-price relationships, measures of shifts in demand and supply, determination of prices, price stabilization, market discrimination, and time elements in prices. Elective, subject to approval of instructor. 3 lec.; 3 cr. (Not offered in 1946-1947.)

54. AGRICULTURAL POLICY: Public policies involving conservation and agriculture will be studied and appraised. Production and price control, land-use problems, soil conservation, forest regulation, the objectives and effect of various action programs will be studied. Mr. Woodworth. Elective, subject to approval of instructor. 3 lec.; 3 cr.

55-56. SPECIAL PROBLEMS IN AGRICULTURAL ECONOMICS: Special assignments in readings and problems to satisfy students' needs. Mr. Woodworth, Mr. Grinnell. 1 to 3 cr.

101-102. ADVANCED FARM MANAGEMENT: Principles and problems of Farm Management as applied to the organization and operation of individual farms. Mr. Grinnell. 3 cr.

103. ADVANCED AGRICULTURAL PRICES: The history of Agricultural Prices and the major factors determining prices. Methods of price analysis. Assigned readings and conferences. 3 cr. (Not offered in 1946-1947.)

106. ADVANCED LAND UTILIZATION AND AGRICULTURAL POLICY: An appraisal of national and local policies and proposed action programs affecting American agriculture. Assigned readings and conferences. Mr. Woodworth. 3 cr.

181-182. READING AND RESEARCH IN AGRICULTURAL ECONOMICS: With the advice and consent of the instructor, a student, prepared by training and experience to do independent work, may register for a reading and research course. The student will undertake assigned problems and readings under the guidance of the instructor.

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## AGRONOMY

F. S. PRINCE, *In Charge*

Student majoring in Agronomy should have had basic courses in soils and crops as well as adequate preparation in the Biological and Physical Sciences.

57. SOIL PHYSICS. The physical constitution and colloidal properties of soils: their measurement and relation to structure, water movement, aeration and temperature in soil. Mr. Kardos. Prereq.: Agron. 1, 4, and Phys. 4. 2 lec.; 1 lab.; 3 cr. (Alternate years; not offered in 1946-1947.)

58. SOIL CLASSIFICATION AND MAPPING. The origin, morphology, classification, and mapping of soils. Relationships of the Great Soil Groups of the world to crop production. Special emphasis is devoted to the soils of New Hampshire. Mr. Kardos. Prereq.: Agron. 1, and other courses at the discretion of the instructor. 2 lec.; 1 lab.; 3 cr. (Alternate years; not offered in 1946-1947.)

59. SOIL CHEMISTRY. A study of the methods for evaluating nutrient levels in soils and of principles underlying the liberation, absorption, and fixation of nutrient elements in soils. Mr. Kardos. Prereq.: Agr. Chem. 1, 2, and Agron. 1, 4. 2 lec.; 1 lab.; 3 cr. (Alternate years: offered in 1946-1947.)

60. SOIL CONSERVATION. The causes and effects of soil erosion. Cropping systems, fertilizer practices, and structural devices used in erosion control. Mr. Kardos. Prereq.: Agron. 1, 4, 10. 1 lec.; 2 lab.; 3 cr. (Alternate years; offered in 1946-1947.)

71, 72. AGRONOMY SEMINAR. Library and reference work on special phases of soil and crop problems. Practice in looking up literature and in preparation of reports and abstracts. Mr. Prince and staff. (Formerly given as Agronomy 51-54.) Prereq.: Agron. 1, 4, 10. Elective for Seniors. 1 to 3 cr.

101-102. AGRONOMY. Studies in comparative agronomy. The forage crops of the temperature zone. Origin and classification of the varieties grown. Germination, growth, and maturation of crops; modifications induced by climate and management. Mr. Prince. Prereq.: A major in Agronomy or its equivalent. Conferences, laboratory, and field work. Hours to be arranged. 3 cr.

## ANIMAL INDUSTRY

KENNETH S. MORROW, *In Charge*

Students majoring in Animal Industry are expected to have had satisfactory undergraduate training in Dairy Husbandry, Dairy Industry or Technology, or Animal Husbandry.

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51. ANIMAL BREEDING. The principles and practices of breeding farm animals, including cross-breeding, in-breeding, selection, inheritance, breed analysis, reproductive efficiency, fertility, sterility, Mendelism in relation to farm animals, acquired characters and variation. Practice is given in tracing and studying pedigrees. Mr. Tirrell. 2 lec.; 1 lab.; 3 cr.

52. ANIMAL HUSBANDRY SEMINAR. Library and reference work and the preparation of papers on various animal husbandry subjects. Mr. Tirrell. Prereq.: Animal Husbandry 51. Hours and credits to be arranged.

60. DAIRY SEMINAR. Recent agricultural experiment station and other literature covering the field of dairy production. Practice in looking up literature and in the preparation of oral and written reports. Mr. Morrow, Mr. Keener. 2 lec.; 2 cr.

62. ADVANCED DAIRY SCIENCE. Basic data, fundamental observations, and discussions of research contributing to the present status of the dairy industry. Mr. Moore. Prereq.: Adequate preparation in chemistry and bacteriology. 2 lec.; 2 cr.

64. MILK PRODUCTION. Feeding and management of dairy animals, calf feeding, raising young stock, feeding for economical milk production. Mr. Keener. 2 lec.; 1 lab.; 3 cr.

65. MARKET MILK. The producing, handling, and distributing of market and certified milk; dairy farm inspection; control of milk supply. Mr. Moore. 2 lec.; 1 lab.; 3 cr.

66. ICE CREAM. The making, handling, and marketing of ice cream and ices. Mr. Moore. 2 lec.; 1 lab.; 3 cr.

101. ANIMAL NUTRITION. Incidental lectures, assigned reading, laboratory practice in methods of research with major emphasis on basal metabolism. Mr. Colovos. Prereq.: A major in Animal or Dairy Husbandry, or equivalent. 3 cr.

102. ADVANCED DAIRY CATTLE. Special emphasis will be given to the analysis and formulating of breeding programs and to milk secretion and factors influencing the quantity and quality of milk. Mr. Morrow. Prereq.: A major in Animal Husbandry or Dairy Husbandry. 2 lec.; 1 lab.; 3 cr.

105. PROBLEMS IN ANIMAL BREEDING. Studies in practical breeding problems with beef and dual-purpose cattle, sheep, horses, and hogs. The genetic principles important to successful livestock production will be emphasized. Mr. Tirrell. Prereq.: A major in Animal Husbandry or Dairy Husbandry. 2 lec.; 1 lab.; 3 cr.

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106. MEATS, LIVESTOCK MARKETS, AND PRODUCTS. The essential factors in meat selection, cutting, curing, and smoking; study and discussion relative to the problems of livestock marketing and the procedure in the large central markets. Trips are taken to various packing plants. Mr. Tirrell. Prereq.: A major in Animal Husbandry or Dairy Husbandry. 2 lec.; 1 lab.; 3 cr.

107. TECHNICAL CONTROL. Chemical and bacteriological laboratory methods used in the technical control of milk and milk products. Mr. Moore. Prereq.: Dairy Husbandry 30 or equivalent. 2 lec.; 1 lab.; 3 cr.

109, 110. SPECIAL PROBLEMS IN DAIRY MANUFACTURE. Detailed study of some special phase of dairy manufacturing. Mr. Moore. Prereq.: A major in Dairy Husbandry. Conferences and special assignments. 3 cr.

111, 112. SPECIAL PROBLEMS IN DAIRY PRODUCTION. Study of some special phase of breeding or feeding as related to dairy-herd management. Mr. Morrow, Mr. Keener. Prereq.: A major in Animal Husbandry or Dairy Husbandry. Conferences and special assignments. 3 cr.

### BIOLOGY

C. FLOYD JACKSON, *In Charge*

Students who wish to secure a Master's Degree in Biology or in any one of the three sections of the Biology Department must have completed a major in a Biological Science with at least one year's work in the special field in which the student plans to carry on his Graduate work. Suitable training in the Physical Sciences is also necessary.

### BACTERIOLOGY

LAWRENCE W. SLANETZ, *In Charge*

Students majoring in Bacteriology are expected to have had preparation in the Biological and Physical Sciences and in the basic course in Bacteriology.

53. IMMUNOLOGY AND SEROLOGY. The theories of infection and immunity; production of vaccines, toxins, and antiserums; serological techniques for disease diagnosis and identification of bacteria, including agglutination, precipitin, and complement fixation tests. Mrs. Bartley. Prereq.: Bact. 8. 2 lec.; 2 lab.; 4 cr.

55, 56. PROBLEMS IN BACTERIOLOGY. Special problems, depending upon the training and desire of the student. Elective only upon consultation. Mr. Slanetz and members of the staff. Credits to be arranged.



## GRADUATE SCHOOL

57, 58. BACTERIOLOGY SEMINAR. Reports and discussions on current literature and recent developments in Bacteriology. Mr. Slanetz and staff. Prereq.: Bact. 2 or 8 and consent of instructor. One 2-hour period; 1 cr.

101. PHYSIOLOGY OF BACTERIA. A study of the growth, nutrition, and metabolism of bacteria; influence of physical and chemical environment on growth; bacterial enzymes; protein decomposition and fermentation. Mr. Creelius. Prereq.: Bact. 2 or 8, or equivalent. 3 lec.; 3 cr.

104. SYSTEMATIC BACTERIOLOGY. A study of the development of a systematic classification of bacteria; modern methods of nomenclature and classification; problems encountered in the classification of bacteria. Mr. Slanetz. Prereq.: Bact. 2 or 8 or equivalent. 2 lec.; 2 cr.

## BOTANY

ALBION R. HODGDON, *In Charge*

51. PLANT PATHOLOGY. The nature of disease in plants, the etiology, symptomatology, and classification of plant diseases. Mr. Richards. Prereq.: Bot. 1 or Bot. 3. 1 lec.; 2 lab.; 3 cr.

52. PRINCIPLES OF PLANT-DISEASE CONTROL. Exclusion, eradication, protection, and immunization, and the specific, practical methods used to control plant diseases. Mr. Richards. Prereq.: Bot. 1 or Bot. 3. 1 lec.; 2 lab.; 3 cr.

55. ADVANCED SYSTEMATIC BOTANY. The principles and laws of plant classification and nomenclature; study of plant families, field, and herbarium work. Mr. Hodgdon. Prereq.: Bot. 6. Hours to be arranged. 4 cr.

56. PLANT PHYSIOLOGY. Structure and properties of the cell; absorption and movement of water; metabolism; growth and irritability. Mr. Dunn. Prereq.: Bot. 1 or Bot. 3, and one year of Chemistry. 2 lec.; 2 lab.; 4 cr.

57, 58. PROBLEMS IN (a) SYSTEMATIC BOTANY (b) PLANT PHYSIOLOGY, AND (c) PLANT PATHOLOGY. Elective only upon consultation with Head of Section. Mr. Hodgdon, Mr. Dunn, and Mr. Richards. Hours to be arranged. 2 to 6 credits.

102. PLANT ECOLOGY. Requirements for growth; specialization and adaptation; geographic and physiographic relations. Regional floras. Interpretation and classification of habitat. Specific problems are assigned. Mr. Hodgdon. Prereq.: Bot. 52. Incidental lectures, laboratory, and field work. 4 cr.

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103. MYCOLOGY. Studies of the parasitic and saprophytic fungi, their growth, reproduction, and identification. Mr. Richards. Laboratory and assigned reading. 1 lec.; 2 lab.; 3 cr.

105. ADVANCED PLANT PHYSIOLOGY. Absorption, translocation, transpiration, and excretion of water, and effect of environmental factors upon these phenomena; permeability and mineral nutrition. Mr. Dunn. Prereq.: Bot. 56 or equivalent. Conferences, laboratory, and assigned reading. 3 cr. (NOTE: Both Bot. 105 and 106 should be taken for a complete covering of the subject.)

106. ADVANCED PLANT PHYSIOLOGY. Photosynthesis; respiration, growth, reproduction; and movement; effect of environmental factors on these phenomena. Mr. Dunn. Prereq.: Bot. 56 or equivalent. Conferences, laboratory, and assigned reading. 3 cr.

107. ADVANCED PLANT HISTOLOGY. A methods course in embedding, sectioning, and staining the fungi and tissues of higher plants. Mr. Richards. Prereq.: Bot. 1. Laboratory and assigned reading. 3 cr.

## ZOOLOGY

C. FLOYD JACKSON, *In Charge*

51. PARASITOLOGY. An introductory course concerned with some of the more important parasites causing diseases of man and animals. Living materials will be used as far as possible. Mr. Dobrovolny. Prereq.: Biol. 1-2, and permission of the instructor. 2 lec.; 2 lab.; 4 cr.

52. PATHOLOGY. The principles of general Pathology of vertebrates, including man. The course is designed for students in the fields of Laboratory Technique, Nursing, and Applied Biology. Pre-medical students are strongly advised not to elect this course. Mr. Dobrovolny. Prereq.: Zool. 53, Bact. 1, and permission of the instructor. 2 lec.; 2 lab.; 4 cr.

53. HISTOLOGY. This course gives the student a familiarity with the microscopical anatomy of the principal tissues and organs of vertebrates. Mr. Dobrovolny. Prereq.: Biol. 1-2 and one year of Biology, and permission of the instructor. 2 lec.; 2 lab.; 4 cr.

54. EMBRYOLOGY. A study of the fundamental principles of development. The development process from the egg to the formation of the body and the establishment of the principal organs and systems. Mr. Dobrovolny. Prereq.: Biol. 1-2 and one year of Zoology. 2 lec.; 2 lab.; 4 cr.

55. INVERTEBRATE ZOOLOGY. A survey of the major invertebrate groups, exclusive of insects, with emphasis on free-living forms.

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Evolution of various phyla and their ecological relationships. Mrs. Harrington. Prereq.: Biol. 1-2 and permission of the instructor. 2 lec.; 2 lab.; 4 cr.

57, 58. LABORATORY TECHNIQUE. Methods in histologic technique and examination of blood, urinary sediments, parasites, and zoological preparations. Mr. Dobrovolny. Prereq.: Zool. 53 or equivalent, and permission of the instructor. 1 lec.; 2 lab.; 3 cr.

59-60. ADVANCED PHYSIOLOGY. Human physiology with special emphasis on nutrition, circulation, respiration, excretion, and secretion. Lectures, assigned topics, and laboratory experiments. Mrs. Richardson. Prereq.: Biol. 1-2 and one year of Zoology; 3 lec. or rec.; 3 cr. (3 lec. or rec.; 1 lab.; 4 cr., by permission of the instructor.)

61. HEREDITY AND VARIATION. A study of the physical basis of inheritance, expression, and interaction of the hereditary units, linkage, and variation. Mrs. Richardson. Prereq.: Biol. 1-2 and one year of Zoology. 3 lec.; or rec.; 1 lab.; 3 or 4 cr.

64. NEUROLOGY. Practical study of the morphology, physiology, and histology of the human nervous system. Mrs. Richardson. Prereq.: Biol. 1-2 and one year of Zoology; 3 lec. or rec.; 1 lab.; 4 cr.

71, 72. ECOLOGY OF THE LAND VERTEBRATES. The habits, habitat, life history and economic importance of the land vertebrates with emphasis on their conservation and ecological relationships. Field methods and techniques as applied to these groups will be considered. Mr. Jackson. Prereq.: 12 hrs. Biology; 2 lec.; 1 lab.; 3 cr.

73, 74. ECOLOGY OF THE FRESH-WATER VERTEBRATES. The habits, habitat, and life history of the fresh-water vertebrates of North America with special emphasis on those forms occurring in eastern United States. Special consideration will be given to their conservation and ecological relationships. Field methods as applied to aquatic forms will be considered. Mr. Jackson. Prereq.: 12 hrs. of Biology; 2 lec.; 1 lab.; 3 cr.

75, 76. MARINE BIOLOGY AND OCEANOGRAPHY. A study of marine life with special emphasis on the economic species of fish and shellfish of the northeastern Atlantic coast. Problems concerning their utilization and conservation, together with special methods in oceanography, will be considered. Mr. Jackson. Prereq.: 12 hrs. of Biology. 2 lec.; 1 lab.; 3 cr. (Not offered regular college year 1946-1947.)

95, 96. LIMNOLOGY. Factors affecting biological productivity of fresh-water lakes and streams. Adapted primarily for students interested in fish and game management, wild life conservation, and

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in teaching of Biology. The second semester's work will deal with special problems in Limnology. Mr. Moore. Prereq.: permission of the instructor. 2 lec.; 2 lab.; 4 cr.

97, 98. SPECIAL PROBLEMS AND SEMINAR. Seminar discussions on current zoological literature conducted each week. Advanced students may elect a special problem, provided they present a detailed outline of the subject and can furnish adequate proof of their ability to carry it out with equipment available. Head of the Department and members of the staff. Prereq.: Permission of the Department Chairman. 1-4 cr.

101, 102. ADVANCED VERTEBRATE TAXONOMY AND ECONOMIC FIELD ZOOLOGY. A critical examination of select groups of vertebrates with special reference to local forms, their classification, distribution, and general ecology and conservation. The laboratory work will deal with economic field zoology and will consist of life history studies, detailed ecological surveys of local areas, control of injurious animals, food habit studies, census taking, and studies of factors controlling animal populations. Mr. Jackson. Prereq.: 3 years' work in Biology. 2 lec.; 2 lab.; 4 cr.

107, 108. BIOLOGY OF DEVELOPMENT. A study of the factors involved in the structure of the cell, histogenesis, and in organogeny. The problems related to cell structure and function will be discussed. Cell specificity, physiological maturity, symmetry, organization, rate of development and maturation will be considered. Mr. Dobrovolny. Prereq.: Three years' work in Biology including Histology and Embryology. 2 lec.; 2 lab.; 4 cr.

## CHEMISTRY AND CHEMICAL ENGINEERING

HAROLD A. IDDLES, *In Charge*

Admission to graduate study in Chemistry requires the usual undergraduate courses in General Chemistry, Analytical Chemistry, Organic Chemistry, and Physical Chemistry with the supporting courses in Mathematics and Physics.

53-54. ORGANIC CHEMISTRY. Lectures on the chief divisions of organic chemistry, aliphatic and aromatic, with the needs of the pre-professional student in mind. A more detailed consideration of carbohydrates and proteins follows. The laboratory technique of organic chemical methods as illustrated in the preparation and purification of typical organic compounds. Mr. Funkhouser. Prereq.: Chem. 3, 4, and 26 when possible. 3 lec.; 2 lab.; 5 cr. Deposit: \$10 for the year.

55-56. STRUCTURAL AND THEORETICAL PROBLEMS OF MODERN ORGANIC CHEMISTRY. An intensive review of the methods of preparation and reactions of the principal classes of organic compounds. Em-

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phasis is on the working of assigned problems. The electron theory of Organic Chemistry is used to correlate the chemical behavior of unsaturated compounds, free radicals, and other classes. Mr. Atkinson. Prereq.: Chem. 48 or 54. 3 lec.; 3 cr.

62. **ADVANCED METHODS OF QUANTITATIVE ANALYSIS.** The theory and technique of special and recently developed methods of analysis such as colorimetry, turbidimetry, potentiometry, and spectrography. Sufficient experience is obtained to allow the development of considerable skill in even the more complex methods. Mr. Daggett. Prereq.: Chem. 22. 3 lec.; 2 lab.; 5 cr. Deposit: \$5 for the semester.

71-72. **UNIT PROCESSES.** The important inorganic and organic industrial chemical processes from the point of view of the basic chemical reactions and physical operations involved. Mr. Zimmerman. Prereq.: Chem. 22. 2 lec.; 2 cr.

74-75. **UNIT OPERATIONS.** The theory and practice of the fundamental chemical engineering unit operations, including flow of fluids, flow of heat, evaporation, distillation, drying, filtration, gas, absorption, extraction, humidification and air conditioning, crystallization, crushing and grinding, and size separation. Mr. Zimmerman. Prereq.: Chem. 71, 83. 3 lec.; 3 cr.

76. **CHEMICAL ENGINEERING ECONOMY.** The economic factors involved in industrial chemical processes and the application of economic balances to the design and selection of chemical engineering equipment. Mr. Zimmerman. Prereq.: Chem. 75, 77. 3 lec.; 3 cr.

77. **UNIT OPERATIONS LABORATORY.** Experiments based upon the unit operations are performed on typical chemical engineering equipment. Mr. Zimmerman. Prereq.: Chem. 74, 84. 3 lab.; 3 cr. Deposit: \$5 for the semester.

78. **CHEMICAL PLANT DESIGN.** The design and layout of chemical plants and equipment. The assigned problems are of a practical nature, such as the manufacture of some chemical product, and their solution will include the design or selection of all equipment and drawings of equipment, plant and layout. Mr. Zimmerman. Prereq.: Chem. 75, 77. 3 lab.; 3 cr.

80. **CHEMICAL ENGINEERING PROJECT.** Each student selects a research problem which he carries out independently under Faculty supervision. Intensive study in both the library and the laboratory and a satisfactory thesis at the completion of the work are required. Mr. Zimmerman. Prereq.: Chem. 75, 77. 4 lab.; 5 cr. Deposit: \$5 for the semester.

82. **PRE-MEDICAL AND PRE-DENTAL PHYSICAL CHEMISTRY.** A brief review and survey of the more important fundamental topics of

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Physical Chemistry; thereafter, those topics of Physical and Theoretical Chemistry which have application in the Medical, Biological, and Agricultural Sciences. Mr. Torgeson. Prereq.: Chem. 2, Phys. 2, 6, or 8, Math. 6 or equivalent. 3 lev.; 3 cr.

83-84. ELEMENTARY PHYSICAL CHEMISTRY. The properties of gases, liquids and solids; principles of thermodynamics and applications; solutions, ionic theory, chemical equilibria, thermochemistry, conductance and electromotive force; principles of kinetics and their application to reaction rates. The laboratory work will include accurate measurements illustrating the principles studied in the lectures. Mr. Torgeson. Prereq.: Chem. 22, Math. 18, Phys. 8. 3 lec.; 2 lab.; 5 cr. Deposit: \$10 for the year.

85-86. ADVANCED PHYSICAL CHEMISTRY. A complete review of Elementary Physical Chemistry followed by a study of the structure and properties of matter. In the latter part of the course the subject matter will include radioactivity, atomic structure, crystal structure, and related topics. Mr. Grilly. Prereq.: Chem. 84 or equivalent. 2 lec.; 2 cr.

87-88. CHEMICAL LITERATURE AND SEMINAR. Instruction in the use of the chemical library. Problems which require the use of all types of chemical literature, not only for locating specific factual material but also for the purpose of carrying out detailed searches on the laboratory and economic phases of typical chemical problems are assigned. Mr. Atkinson. Prereq.: Chem. 48 and 82. 1 lec.; 1 cr.

111. ORGANIC CHEMISTRY. The chemistry of the polynuclear compounds and heterocyclic systems. Mr. Iddles. 3 rec.; 3 cr.

112. ORGANIC CHEMISTRY. The chemistry of natural products. Mr. Iddles. 3 rec.; 3 cr.

115. ORGANIC CHEMISTRY LABORATORY. QUALITATIVE ANALYSIS. The reactions and properties of organic compounds. Use of group reactions in the identification of organic substances. Mr. Atkinson. 1 rec.; 2 lab.; 3 cr.

116. ORGANIC CHEMISTRY LABORATORY. MICRO-QUANTITATIVE ANALYSIS. The combustion for carbon and hydrogen, Dumas nitrogen, Kueldahl nitrogen, estimation of halogens, of sulphur, and of organic radicals. Mr. Atkinson. 1 rec.; 2 lab.; 3 cr.

121. PHYSICAL CHEMISTRY. CHEMICAL THERMODYNAMICS. The application of thermodynamics to Chemistry. The principles of thermodynamics will be thoroughly reviewed. These principles will be applied in detail to the phase rule, chemical equilibrium, electromotive force, theory of solutions, specific heats, and similar topics. Mr. Grilly. Prereq.: One year of Physical Chemistry. 3 rec.; 3 cr.

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122. PHYSICAL CHEMISTRY. CHEMICAL KINETICS. A study of kinetics of homogeneous and heterogeneous reactions in gaseous and liquid systems, including an introduction to photo-chemistry. Mr. Daggett. Prereq.: One year of Physical Chemistry. 3 rec.; 3 cr.

124. ADVANCED PHYSICAL CHEMISTRY LABORATORY. The more modern experimental technique of Physical Chemistry. Emphasis on the needs and interests of each individual student. Topics will include the measurements of refractive index, molecular rotation, activity coefficients by vapor pressure, and E.M.F. methods, heterogeneous equilibrium constants, and kinetic constants. Mr. Torgesen. 1 lec.; 2 lab.; 3 cr.

131-132. COLLOQUIUM IN CHEMISTRY. A description of the series of lectures to be presented will be announced for each semester. Colloids, Mr. Torgesen; Advanced Inorganic Chemistry, Mr. Haendler; History of Chemistry, Mr. Funkhouser; Organic Chemistry, Mr. Atkinson; Physical Chemistry, Mr. Grilly; Analytical Chemistry, Mr. Daggett. 3 lec.; 3 cr.

135. UNIT OPERATIONS. FLUID FLOW, HEAT FLOW, AND EVAPORATION. An advanced course dealing with the fundamental theory and applications of these operations. Mr. Zimmerman. Prereq.: Chem. 74 or equivalent. 2 lec.; or rec.; 2 cr.

136. UNIT OPERATIONS. DIFFUSION OPERATIONS. An advanced study of the principles of diffusion and their application to the unit operations of distillation, absorption, drying, humidification and extraction. Mr. Zimmerman. Prereq.: Chem. 75 or equivalent. 2 lec. or rec.; 2 cr.

141, 142. SEMINAR. Presentation and discussion of recent investigations in the field of Chemistry. No credit.

151, 152. PROBLEMS IN CHEMISTRY. Conferences, library, and experimental work in some field of Chemistry. Analytical Chemistry and Photo-Chemistry, Mr. Daggett; Inorganic Chemistry, Mr. Haendler; Organic Chemistry, Mr. Iddles, Mr. Funkhouser, Mr. Atkinson; Physical Chemistry, Mr. Torgesen; Physical Chemistry, Mr. Grilly, Mr. Torgesen; Chemical Engineering, Mr. Zimmerman. Prereq.: Special permission. Credits to be arranged.

## CIVIL ENGINEERING

EDMOND W. BOWLER, *In Charge*

In addition to the general requirements for all Graduate Students, a candidate for the degree of Master of Science in Civil Engineering must present evidence of undergraduate training equivalent to that

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given to candidates for the Bachelor of Science Degree in this department. A thesis of professional character and no fewer than 21 semester credits of course work constitute the requirements for the Master's Degree.

52. **FLUID MECHANICS.** Properties of fluids; statics of fluids; theorems and criteria of fluid motion; fluid flow through orifices, tubes, nozzles and pipes; flow over weirs; flow in open channels; dynamics of fluids in motion. Laboratory exercises and stream gaging practice. Mr. Bowler. Prereq.: Math. 8. 3 rec.; 1 lab.; 4 cr.

61. **HIGHWAY ENGINEERING AND TRANSPORTATION.** The economics of location and design of highways and city streets; methods of construction, maintenance and specifications governing the various types of surfaces; administration and financing of highway systems; special emphasis on highway transportation. Field location and the complete design of a section of highway are included. Mr. Skelton. Prereq.: C. E. 4, 6, and 15. 2 rec.; 2 lab.; 4 cr.

62. **SOIL MECHANICS AND FOUNDATIONS.** The principles underlying the behavior of various soils when subjected to structural loads. Problems and methods encountered in foundation design and construction, building codes and legal aspects of foundation construction, also test borings and other underground exploration methods. In the laboratory tests are made on various soils for classification, grain size, permeability and consolidation. Reports and typical problems are included. Mr. Skelton. Prereq.: C. E. 65. Required of Seniors in Civil Engineering. 2 lec.; 1 lab.; 3 cr.

63-64. **HYDRAULIC AND SANITARY ENGINEERING.** Precipitation, water losses, run-off, drainage areas, stream flow, water power estimates, hydraulic turbines, dams and waterways; the sources, quantity, quality, and sanitary aspects of public water supplies; the methods of purification and distributing systems; the theory and problems of sewage, the principles governing the disposal of sewage, and the various methods of sewage treatment. Computations, reports, and problems of design are included. Mr. Bowler. Prereq.: C. E. 52. 3 rec.; 1 lab.; 4 cr.

65. **STRUCTURAL DESIGN.** Theory and problems relating to the design of steel and timber structures. A steel girder and steel roof truss are completely designed and working drawings prepared. Individual parts of steel bridge trusses and buildings are studied and designed. Emphasis on economy of design, accuracy of results, clarity of vision, and analytical thought. Mr. Skelton. Prereq.: C. E. 28. 2 rec.; 2 lab.; 4 cr.

66. **REINFORCED CONCRETE STRUCTURES.** Theory and design of reinforced concrete structures, such as beams, slabs, columns, footings,



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retaining walls, and small bridges. Problems related to construction and to illustrations of the theory. Mr. Skelton. Prereq.: C. E. 65. 2 rec.; 2 lab.; 4 cr.

101, 102. **ADVANCED HYDRAULICS.** Dimensional analysis, dynamic similarity, mechanics of viscous fluids, fluid flow in pipes, non-uniform flow, alternate stages of flow in open channels, hydraulic jump, and their application to engineering practice. Mr. Bowler. Prereq.: C. E. 64. 3 rec.; 3 cr.

103, 104. **SOIL MECHANICS.** The physical and mechanical properties of soil in relation to engineering structures. The theory of consolidation, shearing resistance, bearing capacity, settlement, earth pressure, and their applications. Mr. Skelton. Prereq.: Permission of the instructor. 3 lec.; 3 cr.

105. **SOIL TESTING FOR ENGINEERING PURPOSES.** Arranged to cover the essential soil tests for engineering purposes. Identification of soils, determination of water content, void ratio, specific gravity, grain size distribution, and Atterberg limits. Tests for the physical properties include: permeability, capillarity, compressibility, rate and magnitude of consolidation, and shearing resistance. Mr. Skelton. Prereq.: C. E. 103 in parallel or as a prerequisite. 1 lec.; 3 lab.; 4 cr.

## ECONOMICS

CARROLL M. DEGLER, *In Charge*

Graduate work is offered in Economics leading to the degree of Master of Arts.

Admission to candidacy for a Master's Degree in Economics is limited to students with a satisfactory undergraduate record. The prerequisite for graduate work consists of a minimum of 24 hours of undergraduate work in Economics and related fields of which at least 12 hours shall have been in Economics. The Economics requirement includes a year's work in Principles of Economics.

The candidate for a Master's Degree must fulfill the general requirements of the Graduate School and the following departmental requirements: 12 hours graduate credit in the Department of Economics in courses numbered above 100; a thesis which may fulfill a maximum of 6 credits toward the course requirement numbered above 100; 18 hours graduate credits in the Department of Economics in courses numbered above 50. Courses in related departments to a maximum of 9 hours may be counted with the permission of the major adviser.

51. **LABOR PROBLEMS.** Historical background and present status of labor organizations and problems. Prereq.: Econ. 2. 3 lec. or rec.; 3 cr.

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52. PUBLIC FINANCE. Theory and practice of public expenditures and collection of public revenues; problems and policies in financial administration, national, state, and local; taxation problems in the state of New Hampshire. Prereq.: Econ. 2. 3 lec. or rec.; 3 cr.

53. MONEY AND BANKING. Theory and practice of money and banking. Mr. Degler. Prereq.: Econ. 2. 3 lec. or rec.; 3 cr.

54. ADVANCED MONEY AND BANKING. Advanced monetary theory and some of the more practical aspects of modern banking. Mr. Degler. Prereq.: A satisfactory average in Econ. 53. 3 lec. or rec.; 3 cr.

55. CORPORATIONS. Development and forms of business organization and combination. Mr. Degler. Prereq.: Econ. 2. 3 lec. or rec.; 3 cr.

57. POSTWAR ECONOMICS PROBLEMS. This course will treat economic adjustments caused by total war; problems of reconversion of the economy from a condition of total war with special emphasis on postwar economic problems. Mr. Degler. Prereq.: Econ. 2. 3 lec. or rec.; 3 cr.

59, 60. SEMINAR IN CURRENT ECONOMIC PROBLEMS. Elective for Seniors majoring in Economics who have attained a satisfactory average in the Department. Mr. Degler and Miss Woodruff. Recitations and reports; 3 cr.

62. PUBLIC REGULATION OF BUSINESS. The Federal control of business organizations and their activities with special reference to recent legislation affecting business. Mr. Alexander. Elective for Juniors and Seniors. 3 lec. or rec.; 3 cr.

63. INTERNATIONAL TRADE. Theory of international trade, foreign exchange, balance of international payments, tariffs and protection; the economic aspects of international relations with particular reference to recent policies. Miss Woodruff. Prereq.: Econ. 2. 3 lec. or rec.; 3 cr.

181, 182. READING AND RESEARCH IN ECONOMICS. With the advice and consent of the instructor, a student prepared by training and experience to do independent work may register for a reading and research course. The student will undertake assigned problems and readings under the guidance of the instructor. Hours and credits by arrangement. Economic History, Miss Woodruff; International Trade, Miss Woodruff; Corporations, Mr. Degler; Money and Banking, Mr. Degler.

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## EDUCATION

A. MONROE STOWE, *In Charge*

For admission to candidacy for a Master's Degree in Education, a student must present, in addition to a Bachelor's Degree, evidence of having satisfactorily completed either an undergraduate major in Elementary Education or (a) a year of Educational Psychology or its equivalent, (b) 18 semester credits in a teaching major subject, and (c) 12 semester credits in a first teaching minor subject.

For the Degree of Master of Education, candidates must submit evidence of having completed satisfactorily the following courses or their equivalents either as undergraduate or as graduate students:

1. ED. 51. *Social Backgrounds of American Education*
2. Either
  - \*ED. 52. *Principles of American Secondary Education*
  - or
  - EL. ED. 95. *Workshop in Principles and Practices of Elementary Education*
3. Either
  - ED. 61 or 62. *Principles and Problems of Teaching in the Secondary School*
  - or
  - EL. ED. 98. *Workshop in Elementary Curriculum Problems*
4. Either
  - ED. 91-92. *Problems in Teaching the Major Subject*
  - or
  - EL. ED. 90. *Workshop in Reading and the Other Language Arts*
  - or
  - EL. ED. 94. *Workshop in Upper-Grade Language Arts and Techniques of Pupil Organization*
5. Either
  - ED. 91 or 92. *Problems in Teaching the Minor Subject*
  - or
  - Any one of the following courses: *Workshop in Administration in the Junior and Senior High School; Problems in the Supervision of High School Teaching; Workshop in Supervision of the Elementary School; Workshop Courses in Primary or Upper Grades; The Teaching of Arithmetic; The teaching of the Social Studies; Science for Elementary School Teachers; Music for Elementary School Teachers; Children's Literature.*
6. ED. 65. *Educational Tests and Measurements.* (Emphasis should be upon the interpretation of tests and measurements)

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\*Not open to students who have completed satisfactorily Education 85, Principles of Secondary Education, which may be substituted for Education 52.

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7. ED. 76. *Philosophy of Education*
8. ED. 89. *Mental Hygiene for Teachers*

The candidate must also present evidence of having taught successfully for three or more years, or, in lieu of such successful teaching, evidence of having satisfactorily completed one semester of supervised teaching, Education 94. Graduate students successfully completing Education 94 with a grade of at least C will receive 9 semester credits toward the Master's Degree. In case of such students it will ordinarily require at least one academic year and a Summer Session in which to meet the requirements of the Master's Degree in Education.

Students who meet the requirements given above are free to select, with the advice of the Head of the Department of Education, the remainder of their work required for the degree from Education and subject-matter courses arranged to secure most effective preparation for the professional work they desire to pursue. Students will be able to choose from a variety of courses designed to be helpful to students interested in increasing their teaching efficiency in the elementary school and the junior high school, as well as in the senior high school, to teachers and administrative officers interested in educational and vocational guidance, to teachers and administrative officers interested in Physical Education activities, and to educational administrators and teachers preparing to enter fields of administration or supervision.

51. SOCIAL BACKGROUNDS OF AMERICAN EDUCATION. The educationally significant aspects and needs of modern democratic society. Mr. Stowe. Prereq.: Open to Juniors, Seniors, and Graduate students. 3 rec.; 3 cr.

(52), 52. PRINCIPLES OF AMERICAN SECONDARY EDUCATION. The development and place of the secondary school in the American system of education; aims and functions of secondary education in our democracy; upward and downward extension of secondary education; articulation with lower and higher educational institutions, and with the community; the secondary school pupil; adjustment of the work of the school to meet individual needs; the offerings, both curricular and extra-curricular, of the secondary school; place and relationships of school board, superintendent, headmaster, and teachers. Mr. Stowe. Prereq.: Open to Juniors and Seniors and Graduate students. 3 rec.; 3 cr.

61, (61). PRINCIPLES AND PROBLEMS OF TEACHING IN THE SECONDARY SCHOOL. (1) Secondary school objectives and the objectives in the teaching of secondary-school subjects; (2) principles of teaching and of directing learning incorporated in teaching which meets the needs of high-school students and attains the objectives of the secondary school; (3) secondary-school tests and the ways in which

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teachers are endeavoring to ascertain the extent to which their objectives are being attained; (4) class management, the purpose of which is to insure conditions favorable to the attainment of the objectives of the secondary school. Mr. Koch. Prereq.: Ed. 42. 3 rec.; 1 two-hour lab.; 4 cr.

65. EDUCATIONAL TESTS AND MEASUREMENTS. The nature of measurement. Classification and evaluation of tests. Standardized tests in subject-matter fields. The construction of tests in classroom practice. Diagnosis and prognosis of pupils' aptitudes, achievements, attitudes, and interests in the public school program with particular emphasis upon the role of tests. Mr. Carroll. Prereq.: Psych. 11. 3 lec.; 3 cr.

75. CHARACTER EDUCATION IN THE SCHOOLS. Environmental factors which exert an important influence upon pupils of adolescent and pre-adolescent age; the development of wholesome ideals, attitudes, habits, personality and character of traits; direct and indirect methods of character development through school subjects, co-curricular and extra-curricular activities. Mr. Bisbee. Open to Seniors and Graduate students who have satisfactorily completed Ed. 42. 2 rec.; 2 cr.

76. PHILOSOPHY OF EDUCATION. A study of current educational objectives and practices and the philosophical foundations upon which they are based. Mr. Koch. Prereq.: Ed. 42, 51, 52. 3 rec.; 3 cr.

83. PRINCIPLES OF EDUCATIONAL AND VOCATIONAL GUIDANCE. A study of the principles of guidance which are helpful in understanding and in solving the problems of guidance in the small high school. Mr. Stowe. 3 rec.; 3 cr.

84. JUNIOR HIGH SCHOOL EDUCATION. The course is designed to trace the evolution of the junior high school and to contrast it with earlier forms of school organization. Among the topics discussed are the particular features and functions of the school; the educational objectives and philosophy underlying its program; the attempt to humanize adolescent education; the school's function in a democracy; the junior high school as a community center; articulation between the junior high school and the elementary and senior high schools. Considerable attention is given to the program of studies and the content of various courses of study in both small and large communities with the purpose of adapting this school unit to the problems of the present. Consideration will be given in this course to extra-classroom activities and their articulation with classroom procedures. Lectures, assigned readings, problems, and discussions. Mr. Bisbee. 2 or 3 rec.; 2 or 3 cr.

87. PRINCIPLES AND PROBLEMS OF SECONDARY-SCHOOL CURRICULUM REORGANIZATION. 3 cr.

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89. MENTAL HYGIENE FOR TEACHERS. A study of the fundamental needs of human beings, with special emphasis on the mental and emotional conflicts of secondary-school students arising from the thwarting of these needs. Ways of recognizing these conflicts by their manifestations, and of helping students to resolve them will be treated extensively in the course. Attention will also be given to the mental hazards of the teaching profession. Mr. Stowe. Prereq.: General course in Psychology. Not open to students who have completed Psych. 47 or 81. 3 rec.; 3 cr.

102. PUBLIC SCHOOL ADMINISTRATION. This course is intended for Graduate students who have had teaching or administrative experience and are looking forward to further work as superintendent, principal or department head. The course will consider the practical applications of approved practices and modern methods of administration in medium-sized school systems. The following selected topics illustrate the nature of the course: Purposes of School Administration; Personal Qualities Essential for Success; Public Relations; Business Aspects; Finance; Program and Curricula Making; Essential Records and Reports; Care of School Property; Teachers' Meetings; Selecting Teachers; and some Unsolved Problems of Administration. Prereq. 3 rec.; 3 cr.

111-112. WORKSHOP IN ADMINISTRATION IN THE JUNIOR AND SENIOR HIGH SCHOOLS. This course will be devoted to a study of basic principles of Educational Administration with their application to the following types of problems in the junior and senior high schools: The internal organization of the school, administering the program of studies, direction of extra-curricular activities, organization and direction of guidance, making the school schedule, selection of the staff, discipline and control, buildings and grounds, equipment and supplies, office organization, records and reports, administering finance, public relations and publicity. The course will be so organized as to permit students to specialize on problems of administration in the junior high school as well as in the senior high schools. As the workshop technique of discussing practical problems will be utilized in the course, it is hoped that members of the group will bring problems for further discussion and study. Designed for individuals preparing for positions as principals and headmasters. Mr. Koch. 6 cr. Offered in the 1946 Summer Session.

114. WORKSHOP IN SECONDARY-SCHOOL CURRICULUM DEVELOPMENT. 3 cr.

117. WORKSHOP IN MATERIALS OF GUIDANCE. 3 cr.

118. WORKSHOP IN PROBLEMS OF ORGANIZATION AND ADMINISTRATION OF GUIDANCE. 3 cr.

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122. PROBLEMS IN THE SUPERVISION OF HIGH SCHOOL TEACHING. This course is designed to be of service to supervising classroom teachers, headmasters and superintendents. It will be devoted to the consideration of the meaning of supervision, its organization, and methods and techniques for evaluating and improving instruction in secondary school. 3 cr.

131-132. RESEARCH PROBLEMS IN SECONDARY EDUCATION. 2-6 cr.

### COURSES IN PROBLEMS IN THE TEACHING OF HIGH SCHOOL SUBJECTS

\*The following courses are devoted to a study of problems of objectives, selection, and organization of subject matter, teaching and testing techniques and classroom management in the teaching of the respective subjects. To be admitted into one of these courses the student must have completed, with a grade of at least C, Education 61 and in addition the courses in the subject and related subjects designated as prerequisites to the respective courses in this group. A student desiring to be considered for Supervised Teaching must complete with a grade of at least C one of these courses in the subject in which he hopes to do supervised teaching. The satisfactory completion of two of these courses is required of students completing the university Teacher-Preparation Program.

AGRICULTURE-EDUCATION (AG-ED) 92. PROBLEMS IN THE TEACHING OF HIGH SCHOOL AGRICULTURE. Mr. Little. Open only to Seniors in Agricultural Teacher Preparation. 3 lec.; 3 cr.

ART-EDUCATION (ART-ED) 91. PROBLEMS OF TEACHING ART IN ELEMENTARY SCHOOLS. 3 cr. Mr. Thomas. Open only to Seniors in Art Education Curriculum.

ART-EDUCATION (ART-ED) 92. PROBLEMS OF TEACHING ART IN SECONDARY SCHOOLS. 3 cr. Mr. Thomas. Open only to Seniors in Art Education Curriculum.

BIOLOGY-EDUCATION (BI-ED) 91. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL BIOLOGY. 3 cr. Mr. Schaefer.

ENGLISH-EDUCATION (ENG-ED) 91. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL ENGLISH. 3 cr.

GENERAL SCIENCE-EDUCATION (GS-ED) 91. PROBLEMS IN THE TEACHING OF GENERAL SCIENCE. 3 cr. Mr. Leavitt.

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*\*For details concerning prerequisites and nature of these courses, see descriptions given under respective subject-matter departments.*

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HISTORY-EDUCATION (HIST-ED) 91. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL HISTORY. 3 cr. Mr. Berg.

HOME ECONOMICS-EDUCATION (HE-ED) 91. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL HOME ECONOMICS. 3 cr. Mrs. McLaughlin. Open only to Seniors in Home Economics Teacher Preparation Curriculum.

LANGUAGE-EDUCATION (LANG-ED) 91. PROBLEMS IN THE TEACHING OF FOREIGN LANGUAGES IN THE HIGH SCHOOL. 3 cr. Mr. Parker.

LATIN-EDUCATION (LAT-ED) 91, 92. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL LATIN. 3 cr. Mr. Walsh.

MATHEMATICS-EDUCATION (MATH-ED) 91. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL MATHEMATICS. 3 cr. Mr. Perkins.

PHYSICAL EDUCATION (P-E) 91. PROBLEMS IN THE TEACHING OF PHYSICAL EDUCATION FOR WOMEN. 4 cr. Miss Beckwith.

PSYCHOLOGY-EDUCATION (PSY-ED) 91. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL PSYCHOLOGY. 3 cr. Mr. Stowe.

### COURSES IN SUPERVISED TEACHING

This work is required in the Teacher-Preparation Program. It is open only to students whose applications are approved by the Head of the Department of Education and the Supervisor of Student Teaching in the subject or subjects in which the applicant desires to do supervised teaching. Applications should be filed in the office of the Department of Education on or before November 15 of the academic year in which the supervised teaching is to be done. No applications for supervised teaching in academic subjects will be considered unless the applicant has completed with a grade of at least C the following courses in Education: 42, 51, 52, and 61, and, with an average grade of C or better, at least 18 semester credits in the subject-matter field in which he desires to teach under supervision. The applicant must also complete with a grade of at least C a course in the problems of teaching the subject in which he desires to do supervised teaching.

Students may be enrolled for from 6 to 12 credits of work in Supervised Teaching in the second semester of the academic year. Students registered in the College of Liberal Arts may count no more than 9 semester credits in Supervised Teaching toward the fulfillment of the major requirements in Education.

EDUCATION-AGRICULTURE (AG-ED) 93. SUPERVISED TEACHING IN HIGH-SCHOOL AGRICULTURE. Prereq.: Senior standing in AG-ED Curriculum.



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EDUCATION-ART (ED-ART) 94. SUPERVISED TEACHING IN SECONDARY SCHOOL ART. Prereq.: ART-ED 92.

EDUCATION-BIOLOGY (ED-BI) 93, 94. SUPERVISED TEACHING IN HIGH-SCHOOL BIOLOGY. Prereq.: BI-ED 91.

EDUCATION-COMMERCE (ED-CS) 94. SUPERVISED TEACHING IN HIGH-SCHOOL COMMERCIAL SUBJECTS.

EDUCATION-ECONOMICS (ED-ECON) 94. SUPERVISED TEACHING IN HIGH-SCHOOL ECONOMICS. Prereq.: HIST-ED 91.

EDUCATION-ENGLISH (ED-ENG) 94. SUPERVISED TEACHING IN HIGH-SCHOOL ENGLISH. Prereq.: ENG-ED 91.

EDUCATION-FRENCH (ED-FR) 94. SUPERVISED TEACHING IN HIGH-SCHOOL FRENCH. Prereq.: LANG-ED 91.

EDUCATION-GENERAL SCIENCE (ED-GS) 94. SUPERVISED TEACHING IN GENERAL SCIENCE. Prereq.: GS-ED 91.

EDUCATION-HISTORY (ED-HIST) 94. SUPERVISED TEACHING IN HIGH-SCHOOL HISTORY. Prereq.: HIST-ED 91.

EDUCATION-HOME ECONOMICS (ED-HE) 94. SUPERVISED TEACHING IN HIGH-SCHOOL HOME ECONOMICS. Prereq.: HE-ED 91.

EDUCATION-LATIN (ED-LAT) 94. SUPERVISED TEACHING IN HIGH-SCHOOL LATIN.

EDUCATION-MATHEMATICS (ED-MATH) 94. SUPERVISED TEACHING IN HIGH-SCHOOL MATHEMATICS. Prereq.: MATH-ED 91.

EDUCATION-PHYSICAL EDUCATION (ED-PE) 93, (93). DIRECTED TEACHING IN PHYSICAL EDUCATION.

EDUCATION-PHYSICAL EDUCATION (ED-PE) 94. SUPERVISED TEACHING OF PHYSICAL EDUCATION IN THE FIELD.

EDUCATION-SOCIOLOGY (ED-SOC) 94. SUPERVISED TEACHING IN HIGH-SCHOOL SOCIOLOGY. Prereq.: HIST-ED 91.

## ELEMENTARY EDUCATION

63. AUDIO-VISUAL EDUCATION IN THE ELEMENTARY SCHOOL. This course will be devoted to a study of the practical problems of audio-visual teaching and is planned to help teachers who wish to vitalize their teaching through the intelligent utilization of silent and sound films and radio broadcasts, as well as film and glass slides, posters, diagrams, pictures and photographs. 2 cr.

84. WORKSHOP IN THE TEACHING OF ENGLISH IN UPPER ELEMENTARY SCHOOLS. This course will attempt to carry on a practical, every-day approach to the teaching of various forms of English: creative

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writing, oral English, mechanics of writing, choric speech and some social studies work carried into the English field. The afternoon sessions will discuss questions or problems that may arise from the demonstration work. Teachers will also be asked to contribute some of the same type of material that has been required from the children. In other words, the entire course will be based on "doing" and ideas — rather than on text-books and theories of education only. 4 cr

90. WORKSHOP IN READING AND OTHER LANGUAGE ARTS. Designed to give the students an understanding of the methods and materials of instruction in Reading. Skills, techniques, and attitudes necessary to insure in children a permanent love of, and interest in, reading will be demonstrated in the observation periods and analyzed in the discussion groups. The relationship of Reading to the other Language Arts in the elementary school will also be considered. The course will include a one-hour observation in the demonstration class each day and three periods each week in discussion and study of children's problems in Reading as well as in other Language Arts. 4 cr.

91. THE TEACHING OF ARITHMETIC. Planned to meet the needs of students, teachers, and supervisors concerned with the instruction of Arithmetic in the first six grades. The purpose of the course is the improvement of the content and methods in elementary-school Arithmetic. Among the topics considered are philosophy underlying Arithmetic instruction; psychological factors in the teaching of Arithmetic; development of number concepts; methods of instruction in the fundamental processes; the place of drill; problem solving; diagnostic and remedial work; evaluating pupil accomplishment. Assigned readings and problems, discussions, demonstrations, and conferences with the instructor. 3 cr.

94. WORKSHOP IN UPPER-GRADE LANGUAGE ARTS AND TECHNIQUES OF PUPIL ORGANIZATION. 4 cr.

95. WORKSHOP IN PRINCIPLES AND PRACTICES OF ELEMENTARY EDUCATION. 3 cr.

97. WORKSHOP IN SUPERVISION OF THE ELEMENTARY SCHOOL. Concerned with the problems arising in supervision of a modern elementary school. Some of these are: Supervision and functions of the present elementary school; Types of organization; Classification and promotion of pupils; "Marks" and "report cards;" Organization and supervision of the program of instruction; Provisions for exceptional children; Supervision of teacher improvement; Public relations; Autocratic versus democratic methods of supervision; Supervisory techniques for different types of teaching; Development of co-operation among teachers; Evaluation of the school program. Students will be encouraged to work out problems in relation to teach-

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ing positions held by each. This course is intended for superintendents of schools, elementary supervisors or principals, or persons preparing for such positions. The demonstration class will be used as a laboratory for the work in supervision. Opportunities will be provided for individual conferences. 3-6 cr.

98. WORKSHOP IN ELEMENTARY-SCHOOL CURRICULUM PROBLEMS. 3 cr.

### ELECTRICAL ENGINEERING

L. W. HITCHCOCK, *In Charge*

To become a candidate for a Master's Degree in Electrical Engineering a student should have completed work equivalent to that required in this field, at the University of New Hampshire, and should have maintained an average grade of B for his undergraduate course.

53-54. ELECTRICAL ENGINEERING. Direct current generators, direct current motors, alternating current circuits, alternators, and transformers. Prereq.: Phys. 8, Math. 18, and E. E. 2. 3 rec.; 3 cr.

55. ELECTRICAL ENGINEERING. A continuation of Electrical Engineering 54. Induction motors, regulators, synchronous motors, converters, and rectifiers; transmission line regulation, efficiency, insulation, lightning protection, sag and tension, etc. Prereq.: E. E. 54. 3 rec.; 3 cr.

58. RADIO AND WIRE COMMUNICATION. Radio frequency amplifiers and oscillators and the principles of radiation. Principles of basic telephone apparatus and circuits. A detailed study of telephone transmission including inductive interference, equivalent networks, the infinite transmission line, the determination of line and cable characteristics, repeaters, filters, measurement of transmission characteristics. Mr. Mace. Prereq.: E. E. 7. Elective for Seniors in Electrical Engineering. 3 rec.; 1 lab.; 5 cr.

60. ADVANCED CIRCUIT THEORY. Application of Mathematics to the solution of electrical circuit problems, including the use of differential equations, Heavisides' operators, and derivation of fundamental formulas and constants. Prereq.: E. E. 55. 3 rec.; 1 lab.; 4 cr.

76. LABORATORY. Advanced laboratory testing and special problems. The student works on problems of his own selection which have been outlined by him and have received approval. This may be in the form of a semester thesis of original experiments. Prereq.: E. E. 25. 4 lab.; 4 cr.

78. ADVANCED ELECTRONICS LABORATORY. Special radio problems, electron tube applications of a research nature, or studies and appli-

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cations of audio frequency amplifier systems. Mr. Mace. Prereq.: E. E. 7. Lab. and conferences. 4 cr.

101, 102. ADVANCED CIRCUIT THEORY. A continuation of E. E. 60, including the treatment of unbalanced circuits by the method of symmetrical components. Mr. Nulsen. 3 rec.; 3 cr. (Offered in 1947-48.)

103, 104. RADIO PROPAGATION. Antennas and wave-guides. Mr. Mace. (Offered in 1947-1948.)

106. ADVANCED COMMUNICATION, CIRCUIT THEORY. Mr. Mace. (Offered in 1947-1948.)

## ENGLISH

SYLVESTER H. BINGHAM, *In Charge*

A candidate for the degree of Master of Arts in English Literature must present an academic record that shows he is prepared for advanced work in English Literature. He must pass the written examination on English and American Literature which is required of undergraduate majors in English unless he has previously passed it or its equivalent. This requirement must be fulfilled before beginning the thesis.

Special requirements for the Master's Degree: The student who is a candidate for a Master's Degree in English must earn 30 credits: no more than 15 in literature courses open to undergraduate students (those numbered 51-90), at least 9 in literature courses primarily for Graduate Students (those numbered 151-200), and 6 credits in a thesis.

A reading knowledge of French, German, or Latin is required of the candidate.

A student taking a course primarily for graduate students must register for the Graduate course and pass, in partial fulfillment, with a grade of B or better, the corresponding 51-90 undergraduate course; at the same time he must do additional work assigned by his instructor and prepare a paper on an agreed subject connected with his study. An account of the additional work must be turned in to the Chairman of the Department no later than two weeks after the commencement of the course, and the paper must be in the hands of the chairman at least two weeks before the end of the course. A student may not register for a Graduate course if he has previously taken the corresponding undergraduate course.

55, 56. CHAUCER. Mr. Richards. For Juniors, Seniors, and Graduate Students. 3 rec.; 3 cr.

## GRADUATE SCHOOL

\*57, 58. SHAKESPEARE'S PLAYS. The major histories, comedies, and tragedies. Mr. Hennessy. For Juniors, Seniors, and Graduate Students. 3 lec.; 3 cr.

59. MILTON. The minor poetry and the *Paradise Lost*. For Juniors, Seniors, and Graduate Students. 3 lec.; 3 cr. (Given in alternate years; offered in 1946-47.)

60. BOWSELL'S JOHNSON. For Juniors, Seniors, and Graduate Students. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

61. WORDSWORTH. For Juniors, Seniors, and Graduate Students. 3 lec.; 3 cr. (Given in alternate years; offered in 1946-47.)

62. BROWNING. Mr. Daggett. For Juniors, Seniors, and Graduate Students. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

63, 64. ENGLISH LITERATURE IN THE SIXTEENTH CENTURY. For Juniors, Seniors, and Graduate Students. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

65, 66. ENGLISH LITERATURE IN THE SEVENTEENTH CENTURY. Mr. Towle. For Juniors, Seniors, and Graduate Students. 3 lec.; 3 cr. (Given in alternate years; offered in 1946-47.)

67, 68. ENGLISH LITERATURE IN THE EIGHTEENTH CENTURY. Mr. Bingham. For Juniors, Seniors, and Graduate Students. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

69, 70. THE ENGLISH ROMANTIC PERIOD. Wordsworth, Coleridge, Lamb; Byron, Shelley, Keats, Hazlitt, DeQuincy. Mr. Daggett. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

71, 72. VICTORIAN PROSE AND POETRY. Major non-fictional prose from Carlyle to Stevenson and major poetry from Tennyson to Hardy. Mr. Hennessy. For Juniors, Seniors, and Graduate Students. 3 lec.; 3 cr. (Given in alternate years; offered in 1946-47.)

73, 74. BRITISH LITERATURE OF THE TWENTIETH CENTURY. Mr. Daggett. For Juniors, Seniors, and Graduate Students. 3 lec.; 3 cr. (Given in alternate years; offered in 1946-47.)

75. NEW ENGLAND RENAISSANCE. Emerson, Thoreau, and other transcendentalists. Mr. Scudder. For Juniors, Seniors, and Graduate Students. 3 lec.; 3 cr. (Given in alternate years; offered in 1946-47.)

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\*English 57, 58 is a required course for English majors and may not be used in fulfillment of the requirement of one semester in the great-figure group.

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76. AMERICAN NOVEL IN THE NINETEENTH CENTURY. Mr. Scudder. For Juniors, Seniors, and Graduate Students. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

77. AMERICAN POETRY OF THE NINETEENTH CENTURY. Mr. Scudder. For Juniors, Seniors, and Graduate Students. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

78. AMERICAN HUMOR. Mr. Scudder. For Juniors, Seniors, and Graduate Students. 3 lec.; 3 cr. (Given in alternate years; offered in 1946-47.)

79, 80. AMERICAN LITERATURE OF THE TWENTIETH CENTURY. Mr. Towle. For Juniors, Seniors, and Graduate Students. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

81, 82. INTRODUCTION TO ENGLISH DRAMA. The development of English drama, exclusive of Shakespeare, from the Middle Ages to the present. Mr. Hennessy. For Juniors, Seniors, and Graduate Students. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

83, 84. THE ENGLISH NOVEL OF THE EIGHTEENTH AND NINETEENTH CENTURIES. Mr. Bingham. For Juniors, Seniors, and Graduate Students. 3 lec.; 3 cr.

85, 86. A SURVEY OF ENGLISH AND AMERICAN LITERATURE.\* The Department, under the direction of the Chairman. For Seniors and Graduate Students. 3 lec.; 3 cr.

155, 156. CHAUCER. 3 lec.; 3 cr.

157, 158. SHAKESPEARE. 3 lec.; 3 cr.

159. MILTON. 3 lec.; 3 cr. (Given in alternate years; offered in 1946-47.)

160. BOWSEL'S JOHNSON. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-1947.)

161. WORDSWORTH. 3 lec.; 3 cr. (Given in alternate years; offered in 1946-47.)

162. BROWNING. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

163, 164. ENGLISH LITERATURE IN THE SIXTEENTH CENTURY. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

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\*This course does not carry major credit and cannot be counted toward the Master's degree.

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165, 166. ENGLISH LITERATURE IN THE SEVENTEENTH CENTURY. 3 lec.; 3 cr. (Given in alternate years; offered in 1946-47.)

167, 168. ENGLISH LITERATURE IN THE EIGHTEENTH CENTURY. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

169, 170. THE ENGLISH ROMANTIC PERIOD. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

171- 172. VICTORIAN PROSE AND POETRY. 3 lec.; 3 cr. (Given in alternate years; offered in 1946-47.)

173, 174. BRITISH LITERATURE OF THE TWENTIETH CENTURY. 3 lec.; 3 cr. (Given in alternate years; offered in 1946-47.)

175. THE NEW ENGLAND' RENAISSANCE. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

176. THE AMERICAN NOVEL IN THE NINETEENTH CENTURY. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

177. AMERICAN POETRY OF THE NINETEENTH CENTURY. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

178. AMERICAN HUMOR. 3 lec.; 3 cr. (Given in alternate years; offered in 1946-47.)

179, 180. AMERICAN LITERATURE OF THE TWENTIETH CENTURY. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

181, 182. AN INTRODUCTION TO ENGLISH DRAMA. 3 lec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

183, 184. THE ENGLISH NOVEL OF THE EIGHTEENTH AND NINETEENTH CENTURIES. 3 lec.; 3 cr.

## ENTOMOLOGY

JAMES G. CONKLIN, *In Charge*

Students majoring in this Department are expected to have had preparation in undergraduate Entomology and related sciences.

The program of Graduate study is designed to meet the needs of those students who are planning to take further work leading to a career in professional Entomology.

54. MEDICAL ENTOMOLOGY. Insects and arachnids in relation to public health. The more important disease carriers, their biologies, and means of control. Adapted especially for students interested in public health or medicine. Mr. Blickle. Elective for Juniors and Seniors. 2 lec.; 1 lab.; 3 cr.

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55. HOUSEHOLD INSECTS, STORED PRODUCTS INSECTS. The problems of pest prevention and control in buildings. Pests of fabrics and clothing. Insects affecting foodstuffs. Termites and other insects attacking wooden structures. Mr. Conklin. 1 lec.; 1 lab.; 2 cr. (Given in alternate years; not offered in 1946-47.)

56. FOREST INSECTS. Principles of Forest Entomology. Life histories and habits of more destructive forest insects. Forest insect control. Adapted especially for forestry students. Mr. Conklin. Pre-req.: Ent. 2. 1 lec.; 2 cr.

57-58. ADVANCED ENTOMOLOGY. The anatomy and physiology of insects. Systematic Entomology. Mr. Conklin, Mr. Blickle. Open to others than Entomology majors by permission of the Head of the Department. 2 lec.; 2 lab.; 4 cr.

59-60. ADVANCED ECONOMIC ENTOMOLOGY. Problems in applied Entomology. The literature of Economic Entomology. Investigational methods. Studies of the specialized phases of Entomology. Mr. Conklin, Mr. Blickle. Required of Entomology majors. Open to others than Entomology majors by permission of the Head of the Department. 1 to 3 cr.

101, 102. GRADUATE ENTOMOLOGY. Mr. Conklin, Mr. Blickle. Hours and credits to be arranged.

103, 104. GRADUATE ENTOMOLOGY. Mr. Conklin, Mr. Blickle. Hours and credits to be arranged.

## GEOLOGY

T. RALPH MEYERS, *In Charge*

Students majoring in this Department are expected to have had preparation in Physical, Historical, and Structural Geology, Mineralogy, Mathematics, and Chemistry.

New Hampshire presents many geologic problems, especially in the fields of mineralogy and geomorphic, structural, stratigraphic, and igneous geology.

51-52. MINERALOGY. The minerals that make up the earth's crust; crystals; minerals and their determination by means of their physical and chemical characteristics; and the aggregation of minerals to form rocks. Mr. Meyers. Pre-req.: One course in Geology or one course in Chemistry. 2 lec. or rec.; 1 lab.; 3 cr.

53, 54. ECONOMIC GEOLOGY. First semester: the types of coal and their occurrence in the United States; petroleum, the structures in which it is found, and the distribution and geology of oil fields, especially in the United States; cement materials, building stones, and related materials. Second semester: the metals, their ores, and the



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geology of important ore deposits. Mr. Meyers. Prereq.: One year's work in Geology. 3 lec. or rec.; 3 cr. (Given in alternate years; offered in 1946-47.)

55-56. PALEONTOLOGY. The history, development, and morphology of the various groups of animals and, to a lesser extent, plants, as recorded by fossils found in the rocks of the earth's crust. Prereq.: One year's work in Geology or Zoology. 2 lec. or rec.; 1 lab.; 3 cr. (Given in alternate years; not offered in 1946-47.)

57, 58. GEOLOGIC PROBLEMS. Special problems by means of conferences, assigned readings and field work fitted to individual needs. Any staff member. Prereq.: Permission of the instructor. Credits to be arranged.

101, 102. GLACIAL GEOLOGY. A detailed study of the Glacial Geology, principally of North America, with special emphasis on New England. Mr. Chapman. Prereq.: Courses in Physical Geology and Physiography. 2 rec.; 2 lab.; 4 cr.

103, 104. OPTICAL CRYSTALLOGRAPHY AND PETROGRAPHY. A study of minerals and rocks in powder and in thin sections by means of the petrographic microscope. Mr. Meyers. Prereq.: Courses in Mineralogy and Physics. 1 rec.; 2 lab.; 3 cr.

105, 106. RESEARCH. Work on special problems. Areal Geology and Petrography, Mr. Meyers and Mr. Stewart; Geology of Pegmatites, Mr. Stewart; Geomorphology, Mr. Chapman; Mineralogy, Mr. Meyers; Structural and Metamorphic Geology, Mr. Stewart. Prereq.: Special permission. Credits to be arranged.

## GOVERNMENT

NORMAN ALEXANDER, *In Charge*

The Department of Government offers Graduate work leading to the degree of Master of Arts in Government. To qualify for Graduate work in this Department a student must have completed at least 24 semester credits of work in the Social Sciences with a minimum of 12 credits in Government, 6 of which must be in American Government. In addition, a candidate must satisfy the scholastic standards and any other requirements for admission determined by the Graduate School.

The requirements for a Master's Degree in Government are: (1) 12 credits of work in courses numbered over 100, 6 of which will be granted for the required thesis; (2) at least 9 additional credits of work in courses numbered from 51-99 offered in the Department of Government; (3) 9 credits in Graduate courses offered by other Social Science departments may be counted toward the degree; (4) satisfaction of other academic requirements of the Graduate School.

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51-52. CONSTITUTIONAL LAW. A case study of the American Constitution stressing the powers of Congress and the President, limitations upon state legislation, and the nature of the judicial process. Consideration is given to the economic and social aspects of Constitutional Law principles. Mr. Alexander. Prereq.: A year's work in American Government. 3 lec. or rec.; 3 cr.

53. INTERNATIONAL LAW. The rules governing the conduct of nations, states; national and international jurisdiction; pacific relations of states; relations of belligerent states; rights and duties of neutrals. 3 cr.

55. WORLD POLITICS. A survey of the various forces and major factors influencing the development of modern international politics. The importance of geography, economics, militarism, and modern scientific inventions in shaping world politics. Diplomacy of war and peace, large powers against small nations, the balance of power, postwar problems, and international planning. 3 lec. or rec.; 3 cr.

56. INTERNATIONAL ORGANIZATION. A detailed study of existing organizations and plans for co-operation, including the analysis of UN as a new world organization, and a comparison with the League of Nations. Special attention is given to a discussion of the various plans for global co-operation in the postwar era. 3 lec. or rec.; 3 cr.

57. PRINCIPLES OF PUBLIC ADMINISTRATION. A study of the principles of administrative organization; problems of management, personnel, budgetary and fiscal control, administrative powers and responsibility. Mr. Harvey. Prereq.: Gov. 1. 3 lec. or rec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

58. PUBLIC PERSONNEL ADMINISTRATION. Types of organization, methods and policies administering public personnel in the modern state. Mr. Harvey. Prereq.: Gov. 1. 3 lec. or rec. 3 cr. (Given in alternate years; not offered in 1946-47.)

63. HISTORY OF POLITICAL THOUGHT. A historical survey of the principal political theories from Plato and Aristotle to the present. The course is also designed to introduce the student to those movements of political thought which lie as the basis of modern theories of government, *e.g.* liberalism, socialism, fascism, democracy. Mr. Harvey. 3 lec. or rec.; 3 cr. (Given in alternate years; offered in 1946-47.)

64. AMERICAN POLITICAL THOUGHT. This course is a survey of American political thought from Revolutionary days to the present, with special emphasis on constitutionalism, federalism, centralization, collectivism and recent theories supporting present-day programs of government. Mr. Harvey. 3 lec. or rec.; 3 cr. (Given in alternate years; offered in 1946-47.)

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65, 66. SEMINAR IN GOVERNMENT AND IN INTERNATIONAL RELATIONS. Readings, paper and reports. Mr. Alexander, Mr. Harvey. 4 cr.

102. THE CONSTITUTION AND CIVIL RIGHTS. The concept of civil rights as expounded by the framers of the Constitution. An analysis of United States Supreme Court decisions interpreting the Bill of Rights. Consideration is given to the social, economic, and political implications of civil liberties. Mr. Alexander. Prereq.: 12 credits of work in Government including Gov. 51, 3 cr. (Given in alternate years; offered in 1946-47.)

104. SEMINAR IN PROBLEMS OF PUBLIC ADMINISTRATION. The Seminar will be devoted to an intensive investigation of selected problems in public administrative management and administrative law. Mr. Harvey. Prereq.: 12 credits of work in Government including Gov. 57. 3 cr. (Given in alternate years, not offered in 1946-47.)

105. SEMINAR IN WORLD POLITICS. A detailed analysis of the major forces and factors influencing the development of modern world politics. Discussion of individual topics selected by students of the seminar; preparation of theses and oral reports in the field of international relations and world politics. Prereq.: 12 credits of work in Government including Gov. 55 or the equivalent. 3 cr.

## HISTORY

PHILIP M. MARSTON, *In Charge*

The candidate for admission who intends to work for the Degree of Master of Arts in History should present evidence of having satisfactorily completed at least 12 semester credits, as an undergraduate, in courses in History, not including courses open to Freshmen, with a grade of C or better. The two undergraduate courses recommended are Hist. 7, 8. *The United States from 1790 to the Present*, and Hist. 19, 20. *Modern European History*. It is highly desirable that the candidate present evidence of having satisfactorily completed, as an undergraduate, the equivalent of the requirements for a major in History as stated in the current University Catalogue. This would include a minimum of 24 semester credits in courses in History not including those open to Freshmen.

51, 52. COLONIAL AND REVOLUTIONARY AMERICAN HISTORY. Colonial beginnings in America, national rivalries, the English colonies, the Revolution, and our national life to 1789. Early forms of Americanism in the making. Mr. Marston. For Juniors, Seniors, and Graduate students. 3 lec. or rec.; 3 cr. (Given in alternate years; offered in 1946-47.)

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59, 60. SOCIAL AND CULTURAL HISTORY OF NEW ENGLAND. From the settlements to the present. The material and intellectual aspects peculiar to New England's social and cultural life. The viewpoint is partly that of the antiquarian. Source materials figure considerably. It is assumed that the student is familiar with the general history of New England. Mr. Marston. For Juniors, Seniors, and Graduate Students. 3 lec. or rec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

63, 64. RECENT WORLD HISTORY. The world from the first World War, exclusive, for the most part, of American affairs, and stressing historical developments in Europe, the Near and Far East. Mr. Yale. For Juniors, Seniors, and Graduate Students. 3 lec. or rec.; 3 cr.

71, 72. HISTORY OF RUSSIA IN THE NINETEENTH AND TWENTIETH CENTURIES. A study of Tsarist Russia in the nineteenth century, its domestic and foreign affairs, and its collapse in 1917; followed by a study of Soviet Russia from the creation of the Soviet Union to the present. Mr. Yale. For Juniors, Seniors, and Graduate Students. 3 lec. or rec.; 3 cr.

81, 82. HISTORY OF THE WEST. The development of the United States as it was influenced by the successive "wests" in our history from Jamestown to the Pacific; the geography and economics of the westward movement. The frontier thesis will be considered in relation to the present day position of the United States as a world power. Mr. Berg. For Juniors, Seniors, and Graduate Students. 3 lec. or rec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

83, 84. DIPLOMATIC HISTORY OF THE UNITED STATES. A study and reappraisal of American foreign relations in the light of our present position and commitments. The course begins with American independence and will be brought up to date through the use of current periodicals and newspapers. Mr. Berg. For Juniors, Seniors, and Graduate Students. 3 lec. or rec.; 3 cr. (Given in alternate years; offered in 1946-47.)

87, 88. THE INTELLECTUAL HISTORY OF WESTERN CIVILIZATION. The history of ideas and of the great epochs in human thought. A study of the dominant characteristics of the leading cultures and of the transitions from one to the other. The content of the course will be selective rather than inclusive. Special attention will be given to study of some of the major source writings of each period. Mr. Johnson. For Juniors, Seniors, and Graduate Students. 3 lec. or rec.; 3 cr.

HISTORY-EDUCATION (HIST-ED) 91. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL HISTORY. The purposes and objectives of teaching high-school history; selection and organization of teaching material;

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teaching and testing techniques which may be advantageously used in teaching high-school history and the other social studies; experiments in studying and teaching history. Mr. Berg. Open to students who have satisfactorily completed Hist. 7, 8, Govt. 1, 2, Econ. 1 or 3, Soc. 1, and Ed. 61. 3 class meetings; 3 cr.

111, 112. SEMINAR IN THE HISTORY OF NEW ENGLAND. For Graduate Students who wish to specialize in some phase of New England history or the history of New Hampshire. The work is concerned primarily with the study and interpretation of source material and can be correlated with the preparation of a thesis. Mr. Marston. Prereq.: Permission of the instructor. 3 cr. (Not offered in 1946-47.)

113, 114. SOURCES FOR THE STUDY OF COLONIAL AMERICAN HISTORY. For students who have taken Hist. 51, 52 or its equivalent. Training in the methods of historical investigation and in the use of sources in the field of Colonial American History. The preparation of papers based on source materials alone. Mr. Marston. Prereq.: Permission of the instructor. 3 cr.

123, 124. HISTORIOGRAPHY. The lives and writing of some leading historian from earliest times to the present, and their contributions to scope, method, viewpoint, and literary achievement. Mr. Partridge. Prereq.: Permission of the instructor. 3 cr. (Not offered in 1946-47.)

## HORTICULTURE

ALBERT F. YEAGER, *In Charge*

Students will find the Department well equipped for fundamental research on horticultural problems. In addition to the general requirements for all Graduate Students, basic Chemistry and Plant Science courses equivalent to those ordinarily required for a Bachelor's Degree in Horticulture are prerequisites for registration as a Graduate Student in Horticulture.

51, 52. ADVANCED HORTICULTURE. Courses to be elected by students majoring in Horticulture and special students to gain further knowledge and specialization in the field of fruit, flower, vegetable production, and beekeeping. Additional laboratory practice if desirable. Mr. Yeager and staff. Prereq.: Permission to register from Head of the Department. 1 to 3 cr.

52. POMOLOGY: ORCHARD FRUITS. Fundamental principles and experimental data and their applications to orchard problems such as establishing orchards, growth and rest periods, water requirements, soil management, pruning, fruit bud formation, fruit-setting pollination, thinning, and winter injury. Mr. Latimer. Prereq.: Bot. 1. 3 lec.; 3 cr.

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54. **POMOLOGY: SMALL FRUIT CULTURE.** The culture and economic uses of the strawberry, raspberry, blackberry, and grape. Each fruit is considered with relation to its history, propagation, planting, pruning, harvesting, insects and diseases, and domestic uses. Mr. Latimer. Elective for any student. 2 lec.; 2 cr.

55. **SYSTEMATIC SURVEY OF FRUITS.** Important species of fruits and nuts of temperate regions and their botanical relationships. The history, distribution, and merits of each species, and the horticultural varieties developed from it. Mr. Latimer. Prereq.: Bot. 1-2. 2 lec.; 2 cr. (Given in alternate years; offered in 1946-47.)

57. **SYSTEMATIC SURVEY OF VEGETABLES.** Important species of vegetables and culinary herbs and their botanical relationships. The history, distribution and commercial merit of each species and the horticultural varieties developed from it. Mr. Hepler. Prereq.: Bot. 1-2. 2 lec.; 2 cr. (Given in alternate years; not offered in 1946-47.)

65. **COMMERCIAL VEGETABLE PRODUCTION.** The management of commercial vegetable gardens. A study of the important vegetables and their culture including a comprehensive review of recent experimental work in the vegetable field. Mr. Hepler. Prereq.: Hort. 14. 2 lec.; 1 lab.; 3 cr.

91, 92. **HORTICULTURE SEMINAR.** A review of recent horticultural literature and methods of investigational work. Students required to prepare and present papers on selected topics. Mr. Yeager and staff. Students must obtain permission to enroll. 1 lec.; 1 cr.

94. **PLANT BREEDING.** Application of the principles of genetics to practical plant breeding. Hybridization, chemical treatments, and selection as means of producing and improving varieties. Mr. Yeager. Prereq.: Zool. 49. Elective for any student. 2 lec.; 2 cr.

101. **FLOWER BUD FORMATION.** The influence of soil management, orchard fertilization, and resultant chemical composition of fruit plants, on flower bud formation and alternate bearing. Mr. Latimer. Prereq.: Ag. Chem. 2, Hort. 53. 2 lec.; 2 cr.

102. **METHODS OF HORTICULTURAL RESEARCH.** An examination of methods used in laboratory and field by horticultural investigators. Mr. Yeager and staff. Prereq.: Ag. Chem. 2, Bot. 4, Hort. 53, or 65, Math. 5-6 or 21-22. 2 lec.; 2 cr.

103. **WINTER INJURY.** The physiology of winter injury to plants. Mr. Latimer. Prereq.: Bot. 4, Hort. 53 or 65. 2 lec.; 2 cr.

104. **PROPAGATION AND GROWTH.** The problems of water relations, rest period propagation, pruning, and thinning orchard fruits. Mr. Kalin. Prereq.: Ag. Chem. 2, Bot. 4, Hort. 53 or 65. 2 lec.; 2 cr.

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106. POLLINATION AND FRUIT SETTING. Genetical and environmental factors affecting the production of fruit. Mr. Latimer. Prereq.: Bot. 4 (may be taken concurrently), Hort. 53, Zool. 49. 2 rec.; 2 cr.

108. VEGETABLE PROBLEMS. A study of the physiological problems involved in vegetable production. Mr. Hepler. Prereq.: Bot. 4 (may be taken concurrently), Hort. 53 or 65. 2 rec.; 3 cr.

125, 126. RESEARCH IN HORTICULTURE. Mr. Yeager and staff. Prereq.: Hort. 102 (may be taken concurrently). Credits to be arranged.

## LANGUAGES

CLIFFORD S. PARKER, *In Charge*

To be admitted to candidacy for the Degree of Master of Arts in Languages, the student must have met requirements substantially equal to those set up for the fulfillment of an undergraduate major in languages at the University of New Hampshire.

The student must submit an acceptable thesis embodying the results of independent investigation (equivalent to 6 to 9 semester credits in courses primarily for the Graduate Students) and must pass a special oral or written examination, at the end of the period of Graduate study, on the content of all courses taken for Graduate credit.

No more than 6 semester credits may be earned for courses outside this Department.

A Graduate Student in Languages may take all his work in one language or in combinations of courses in two of the following languages: French, German, Latin, Spanish. Courses in General Language and Literature, listed below, may be counted towards the degree.

### General Language and Literature

LANG. 51, 52. SURVEY OF MODERN EUROPEAN LITERATURE. The Renaissance, classicism, romanticism, and realism studied as international movements. Stress will be laid, not upon the details of each national literature, but upon the interdependence of the literatures of the various countries. Conducted in English. 3 rec.; 3 cr. (Not offered in 1946-47.)

LANG. 73-74. GENERAL INTRODUCTION TO THE SCIENCE OF LANGUAGE. An introduction to the science of linguistics. The origins of

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language; the languages of the world, phonology; morphology; syntax; semantics; entymology; language and writing; the science of comparative philology and its development; dialect divergence; the principles of linguistic change, race, culture, and language; the psychology of language. The course, though designed particularly for majors in English or other languages, is open to all Graduate Students. 3 lec.; 3 cr. (Not offered in 1946-47.)

LANGUAGES-EDUCATION (LANG-ED) 91. PROBLEMS IN THE TEACHING OF MODERN LANGUAGES IN THE HIGH SCHOOL. The special objectives, methods, and devices of modern language teaching in high schools. For prospective or actual teachers of French, German, and Spanish. Prereq.: Ed. 61 with grade of C or better and one of the following courses: French 6, German 4, Spanish 4. 3 rec.; 3 cr. Mr. Parker.

### French

53. FRENCH ROMANTICISM AND REALISM. The period from 1800 to approximately 1879; Chateaubriand and Mme. de Stael; the Romantic School (Lamartine, Vigny, Victor Hugo, Dumas, Musset, etc.); the historical novel and drama; the intermingling of romanticism and realism in the work of Balzac; humanitarianism and realism in the novel, the drama, and poetry (Flaubert, Augier, Dumas fils, Leconte de Lisle, etc.). Prereq.: French 6. 3 rec.; 3 cr. Mr. Parker.

54. FRENCH LITERATURE FROM 1879 TO THE PRESENT. The work of Zola, Maupassant, Daudet, Bourget, Verlaine, Becque, and other outstanding writers of the last part of the nineteenth century; the various trends, schools, and individual writers of the twentieth century. Prereq.: French 53. 3 rec.; 3 cr. Mr. Grigaut.

61-62. ADVANCED FRENCH GRAMMAR AND COMPOSITION. A systematic study of French grammar with much oral and written practice. For students who wish to perfect their command of written and spoken French. Prereq.: French 6. (Students are advised to have had French 13-14 or the equivalent.) 3 rec.; 3 cr. Mr. Grigaut.

63-64. FRENCH LITERATURE AND CIVILIZATION OF THE MIDDLE AGES AND THE RENAISSANCE. The various forms and masterpieces of French literature from the beginning to the year 1600. Recommended for Seniors and Graduate Students. Prereq.: French 12 or 54. 2 lec.; 2 cr. Mr. Parker.

91-92. ORAL FRENCH. Accuracy and facility in the use of oral French will be attempted through the study of phonetics and the use of dictation, conversation, the phonograph, and other devices. Prereq.: May be taken concurrently with French 61-62 or after completion of French 14 or 62. 2 rec.; 2 cr. Mr. Grigaut.



## GRADUATE SCHOOL

101, 102. HISTORY OF FRENCH LITERATURE. This course is not an introduction to French literature, but complements what the student has previously learned. The work consists of individual conferences between instructor and student and a large amount of reading. In general, each student is expected to study more carefully the authors of whom he has some knowledge, to fill in the gaps between courses he has taken, and to obtain an integrated knowledge of all French literature. Prereq.: Permission of Head of Department. 3 cr. Mr. Parker.

103, 104. SPECIAL STUDIES IN FRENCH LITERATURE. An intensive study of one or two important authors each semester; their lives, works, and times. Molière and Alfred de Vigny, for example, might supply the material for an entire year's work. The particular authors studied, however, may be changed from year to year in accordance with the needs and tastes of the students electing the course. The work will be conducted largely in French. Prereq.: 12 credits in undergraduate courses in French Literature. 3 cr. Mr. Grigaut.

### German

53-54. GERMAN ROMANTICISM. The revival of the historical and imaginative Middle ages in the first half of the nineteenth century. Prereq.: Two years of college German or the equivalent. 3 class hours; 3 cr. (Not offered in 1946-47.)

57-58. MODERN GERMAN LITERATURE. The development of German literature from 1832 to the present, with special emphasis on the novel and drama. Authors considered are Grillparzer, Hebbel, Ludwig, Keller, Meyer, Wagner, Hauptmann, Sudermann, Thomas Mann, Rilke, George and Schnitzler. Prereq.: Two years of college German or the equivalent. 3 class hours; 3 cr. (Not offered in 1946-47.)

63-64. HISTORY OF GERMAN LITERATURE. Its development from pagan to modern times. Representative works read in and out of class. The history of German civilization is taken up parallel with the history of literature. Prereq.: Two years of college German or the equivalent. 3 class hours; 3 cr. Mr. Schoolcraft. (Offered in 1946-47.)

### Latin

51-52. PHILOSOPHY AND SATIRE. Philosophy, religion, natural science and social theories of the Romans, as exemplified in the writings of Horace, Martial, and Cicero. Prereq.: Latin 6. 3 rec.; 3 cr. (Given in alternate years; not offered in 1946-47.)

55-56. LITERATURE AND HISTORY. A comprehensive view of Latin Literature of the Golden Age, particularly the works of Caesar,

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Cicero, and Virgil. Literary value and historical content will be studied as well as such background of the history of Rome during the period as is necessary for the student or teacher of the classics. Prereq.: Latin 8. 3 rec.; 3 cr. Mr. Walsh. (Offered in 1946-47.)

LATIN-EDUCATION (LAT-ED) 91-92. PROBLEMS IN THE TEACHING OF HIGH SCHOOL LATIN. The study of methods, objectives, and problems of teaching high school Latin will be carried on throughout the year concurrently with work in composition and conversation. Prereq.: Permission of the instructor. 3 rec.; 3 cr. (Not offered in 1946-47.)

125, 126. LATIN LITERATURE. A study of Latin Literature through the medium of selections from the works of the more important authors from the beginnings to the decline of literary Latin. This reading will be supplemented by a detailed study of some special field, author, or group of authors. Prereq.: 3 rec.; 3 cr. Mr. Walsh.

### Spanish

101, 102. SPANISH LITERATURE OF THE MIDDLE AGES. Masterpieces and writers of Spanish Literature from the beginnings to 1500. Their historical background. Conducted as far as possible in Spanish. Prereq.: 3 years of college Spanish or equivalent; 3 lec.; 3 cr. Mr. Berzunza.

## MATHEMATICS

HERMON L. SLOBIN, *In Charge*

Students majoring in this Department must have had not less than 30 semester credits in college Mathematics with an average of not less than B, inclusive of a standard course in Differential Calculus, Integral Calculus, and Differential Equations.

51-52. ADVANCED CALCULUS, DIFFERENTIAL EQUATIONS AND THEIR APPLICATION TO ENGINEERING PROBLEMS. Prereq.: Math. 8. 3 rec.; 3 cr.

55-56. ADVANCED PLANE AND SOLID ANALYTICAL GEOMETRY. Prereq.: Math. 8. 3 rec.; 3 cr.

57. THE HISTORY OF MATHEMATICS. Designed especially for those preparing to teach mathematics in high school. An historical background and an appreciation of the development of various fields of mathematics. Mr. Demos. Prereq.: Math. 8. 3 rec.; 3 cr.

58. VECTOR ANALYSIS. Vector and scalar algebra and geometry, differentiation and differential operators, applications to electrical theory and to mechanics, dynamics, and hydro-dynamics. Mr. Solt. Prereq.: Math. 8. 3 rec.; 3 cr.

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61-62. INTRODUCTION TO STATISTICAL METHODS. Graphical representation of statistical data, frequency distribution, averages, measures of dispersion, index numbers, linear correlation, time series. Prereq.: One year of college Mathematics or its equivalent. Mr. Kichline. 3 rec.; 3 cr.

63-64. ECONOMIC AND SOCIAL STATISTICS. A continuation of 61, 62, including a more thorough study of correlation, multiple and partial correlation, time series including trend and seasonal variation and cycles, sampling, variance, tests of significance. Material selected to meet the needs of advanced students and to throw light on statistical research methods. Mr. Kichline. Prereq.: Math. 61, 62. 3 rec.; 3 cr.

71-72. ADVANCED ALGEBRA. Matrix theory, including elementary divisors and invariant factors; linear transformations; quadratic bilinear, and Hermitian forms; invariants and covariants with geometric applications; and topics from the theory of equations, including symmetric function, and groups of substitutions. Mr. Demos. Prereq.: Math. 8. 3 rec.; 3 cr. (Given in alternate years; offered in 1946-47.)

MATHEMATICS-EDUCATION (MATH-ED) 91. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL MATHEMATICS. The aims and values of secondary-school mathematics, the recommendations of the national committee on mathematics requirements, and the state board requirements; also the subject-matter and the sequence in which it should be presented in both junior and senior high schools, and the various techniques used in teaching secondary-school mathematics. Errors, testing program and remedial teaching. Lectures, assigned readings and discussions. Mr. Perkins. Prereq.: Math. 8, or 34 and 7. Students preparing to teach Mathematics in high school should register for this course. 3 rec.; 3 cr.

101-102. COMPLEX VARIABLE. The theory of analytic functions of a single complex variable by the methods of Acuchy (integrals), Riemann (derivatives) and Weierstrass (series), conformal mapping and Riemann's surfaces, and the elementary theory of elliptic functions. Mr. Demos. Prereq.: Math. 51. Hours to be arranged. 3 cr.

103-104. DIFFERENTIAL GEOMETRY. Plane and space curves; first and second differential forms of a surface; theorems of Meusnier and Euler; lines of curvature; asymptotic lines; conjugate lines; geodesics; theorems of Gauss and Codazzi; developable surfaces; Liouville surfaces; problems on mapping. Mr. Giddings. Prereq.: Math. 8. 3 rec.; 3 cr.

105-106. EDUCATION STATISTICS. A study of the statistical methods dealing with data pertaining to problems in education. The topics to be considered include central tendency, dispersion, linear correla-

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tion, non-linear correlation, partial and multiple correlation, the normal probability curve, curve fitting, sampling, and variance. In considering the several problems, emphasis will be placed on theory and on application to concrete numerical data. Mr. Kichline. Prereq.: 61, 62. 3 rec.; 3 cr.

107-108. INFINITE SERIES AND PRODUCTS. This course includes selections from the following topics: theories of irrationals; series of positive terms; convergence tests; general series; double series; transformation of series; infinite products; Fourier, Dirichlet, and power series; special series; and divergent series. Mr. Slobin. Prereq.: Math. 51. 3 cr.

109-110. ANALYTICAL MECHANICS. Statics and dynamics of particles and rigid bodies. Lagrange's equations. Mr. Solt. Prereq.: Math. 51. 3 rec.; 3 cr.

113-114. ADVANCED STATISTICS. This course centers about the problem of sampling and includes such topics as the normal distribution and the problem of inference, the chi-square test, the t-test, and a study of variance and covariance. Numerous applications are introduced. A general review of the more important statistical methods is included. Mr. Kichline. Prereq.: Math. 63, 64. Hours and credits to be arranged.

### MECHANICAL ENGINEERING

EDWARD L. GETCHELL, *In Charge*

To become a candidate for a Master's Degree in Mechanical Engineering a student should have completed work equivalent to that required in this field, at the University of New Hampshire, and should have maintained an average grade of B for his undergraduate course.

55-56. AUTOMOTIVE ENGINEERING. The internal combustion engine, including its thermodynamics, carburetion, lubrication, and vibration. Some features of the design of the principal moving parts of the automotive vehicle. Mr. Stolworthy. Prereq.: M. E. 8 and 24. 2 rec.; 1 lab.; 3 cr.

65. CONTRACTS AND SPECIFICATIONS. Legal principles underlying Engineering work, including contracts, negotiable instruments, and specifications. 3 rec.; 3 cr.

66. ENGINEERING ECONOMY. The principles which form the basis of Engineering procedures for obtaining the highest ratio of utility to cost. 3 rec. 3 cr.

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101, 102. **ADVANCED THERMODYNAMICS.** The general equations of thermodynamics and their application to fluids such as air and steam; heat transmission; current applications and advances in thermodynamics. Mr. Donovan. 3 rec.; 3 cr.

105, 106. **ADVANCED MECHANICS OF MATERIALS.** To review and show the limitations of the ordinary formulas of strength of materials. To consider the conditions under which these limitations hold and to extend the subject to more complex topics than those previously considered. To prevent a more detailed study of the concepts and methods used in the analysis of stresses in structures and machine members. Further study of stresses in plates, thick cylinders, rotating cylinders, and shafts; stresses in curved members under flexure; stress concentrations and analysis of stresses in statically indeterminate structures by elastic strain energy and photo-elastic methods. Mr. Getchell. Prereq.: M. E. 8. 3 rec.; 3 cr.

## POULTRY HUSBANDRY

T. B. CHARLES, *In Charge*

Requirements for Graduate Study: B. S. Degree, and sufficient fundamental courses in Poultry Husbandry to qualify for special work in this field.

53, 54. **POULTRY PROBLEMS.** Students are given a selection of various problems and are required to compile and present accurate and detailed information in their solution. Mr. Charles, Mr. Corbett, Mr. Ringrose. 1 to 3 credits.

56. **TURKEY BREEDING AND PRODUCTION.** Subject matter covered includes breeds and their commercial importance, breeding methods, including the National Turkey Improvement Plan and Record of Performance; brooding and rearing methods; feeding, housing, and management practices. Mr. Charles. 2 rec.; 2 cr.

101, 102. **ADVANCED POULTRY DISEASES.** A study of the cause and effects of disease applied to the body as a whole. Lectures supplemented by laboratory demonstrations of the basic pathology of diseased tissue. A detailed discussion of diagnosis, prevention, control and treatment of poultry diseases. Mr. Allen and Mr. Corbett. Prereq.: Poultry Husbandry 25. Bact. 2, and Zool. 53 and 54. (Zool. 53, 54 may be taken simultaneously with Poultry Husbandry 101, 102.) 3 lec.; 3 cr.

103, 104. **ADVANCED POULTRY SCIENCE.** A comprehensive study of (1) the inheritance of morphological and physiological characters in poultry; (2) problems involved in the production, processing and

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sale of poultry products, and (3) the study of metabolism and physiology of digestion with special emphasis on mineral needs and deficiency diseases of poultry. Mr. Charles and Mr. Ringrose. Prereq.: Poultry Husbandry 29, 19, and 6, or their equivalent. 2 lec.; 1 lab.; 3 cr.

105, 106. SEMINAR. A survey of recent literature and research in Poultry Husbandry. Department staff. 1 cr.

107, 108. POULTRY PROBLEMS. Students are given a selection of various problems and are required to compile and present accurate and detailed information in their solutions. Hours and credits, not to exceed three, are to be arranged.

## PSYCHOLOGY

HERBERT A. CARROLL, *In Charge*

Students who plan to do their Master's work in Psychology should have had an undergraduate major in Psychology or 24 course credits in Psychology and in closely related fields. In general, it is not desirable for a student to attempt to earn a Master's Degree in Psychology at New Hampshire unless he was in the upper half of his class scholastically as an undergraduate student.

51. PSYCHOLOGY OF CHILDHOOD. The mental processes and reactions of the normal child from birth to adolescence studied in order to obtain a comprehensive understanding of the development of the personality of the child. Special emphasis is placed on problems of parents and teachers and the importance of childhood for later adjustment. Mr. Haslerud. Prereq.: Psych. 1. 3 lec.; 3 cr.

57 EXPERIMENTAL PSYCHOLOGY. A study of experimental work in Psychology supplemented by class experiments. Emphasis will be placed on scientific method and experimental procedure. Mr. Haslerud. Prereq.: Psych. 2. 2 lec.; 2 lab.; 3 cr.

58. PSYCHOLOGY OF LEARNING. A study of the principles and theories of learning and forgetting and their application to habit-formation, social learning, and educational problems. Mr. Haslerud. Prereq.: Psych. 2. 3 lec.; 3 cr.

62. PSYCHOLOGY OF PERSONNEL. The application of Psychology to personnel management in business and industry. The use of intelligence, trade, and aptitude tests, and interest questionnaires in employment. The development and maintenance of morale through efficiency methods, favorable conditions of work, and intelligent leadership. Mr. Haslerud. Prereq.: Psych. 33. 3 lec.; 3 cr.

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63. **INDIVIDUAL DIFFERENCES.** A study of individual differences with special emphasis on intellectually gifted and mentally subnormal children. Mr. Carroll. Prereq.: Psych. 2. 3 lec.; 3 cr.

67. **PRINCIPLES OF MEASUREMENT.** A study of the problems involved in objectively measuring mental aptitudes and the results of learning by means of informal and standardized group tests. Special attention will be given to the statistical interpretation of scores. Mr. Carroll. Prereq.: Psych. 2. 3 lec.; 3 cr.

68. **INDIVIDUAL MENTAL TESTING.** Demonstrations and experience in the administration of individual intelligence tests. Major attention will be given to the Terman-Merrill Revision of the Binet-Simon Scales. Mr. Carroll. Prereq.: Psych. 67. 3 lec.; 3 cr.

74. **PSYCHOLOGY OF PERSONALITY.** The course is concerned with the study of the attitudes and motives of the individual. Attention will be given to attempts to classify personality and temperament and methods of measuring personality traits. Mr. Haslerud. Prereq.: Psych. 2. 3 lec.; 3 cr.

77. **PHYSIOLOGICAL PSYCHOLOGY.** A study of the organic bases of behavior. Psychologically relevant topics concerning the nervous system, endocrine glands, sense organs, and so forth, will be considered. Mr. Haslerud. Prereq.: Psych. 2. 3 lec.; 3 cr.

82. **CLINICAL PROBLEMS.** An examination of the objectives, theories, and methods of psychological counseling. Mr. Carroll. Prereq.: Psych. 47. 3 lec.; 3 cr.

98. **SEMINAR IN PSYCHOLOGY.** Mr. Carroll. Prereq.: 15 semester credits in Psychology. 3 cr.

101. **SYSTEMATIC PSYCHOLOGY.** A critical examination of the points of view of the various schools of Psychology. Dr. Carroll. Prereq.: 18 credits of Psychology. 3 cr.

104. **HABIT FORMATION.** A consideration of problems involved in applying theories of learning to the acquisition of cultural patterns, social habits, and personality traits. Mr. Haslerud. Prereq.: 18 credits in Psychology. 3 cr.

181, 182. **READING AND RESEARCH IN PSYCHOLOGY.** With the advice and consent of the instructor, a student prepared by training and experience to do independent work may register for a reading and research course. The student will undertake assigned problems and readings under the guidance of the instructor. Hours and credits by arrangement. Mr. Carroll and Mr. Haslerud.

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## SOCIOLOGY

CHARLES W. COULTER, *In Charge*

A candidate for admission to work for a Master's Degree in Sociology (1) must have been agreed upon as to his fitness to undertake work for a degree by the Dean of the Graduate School and the Head of the Department, (2) must have had at least 12 undergraduate credits in Sociology or their equivalent with an average record of B.

Before being recommended for the Master of Arts Degree, he shall have (1) met all general requirements of the Graduate School; (2) completed: a minimum of 18 hours of work in Sociology, 6 hours in an allied social science field (of these 24 hours at least 6 hours must have been in courses numbered between 100 and 200), and a thesis in the major field carrying 6 hours' credit.

71. CRIME AND ITS SOCIAL TREATMENT. The increase, extent, and more popular theories of crime and delinquency, juvenile and adult. Case studies of individual delinquents with special reference to the influence of family and neighborhood environments; typical social situations and their influence; programs for the social treatment of crime, the reorganization of reformatory institutions, classification of offenders for separate treatments, the "honor system," limited self-government, parole and probation, and the juvenile as agencies for the prevention of delinquency. Mr. Coulter. Prereq.: Soc. 1 and 2, or by special permission. 3 lec. or rec.; 3 cr.

72. THE FAMILY. The rise of the marriage institution and the family. Divorce, desertion, changing status of women, child welfare, child labor laws, and related modern problems. Mr. Coulter. Prereq.: Soc. 1 and 2, or by special permission. 3 lec. or rec.; 3 cr.

73. PRINCIPLES OF SOCIAL CASE WORK. The present trend in family case work; the techniques of interviewing, diagnosis, treatment and case recording; the significance of present-day relief practices. Mr. Coulter. Prereq.: Soc. 1 and 2. 3 lec. or rec.; 3 cr.

75. METHODS OF SOCIAL RESEARCH. The application of the historical survey, statistical, and case methods of social data; the use of bibliography, definition, and selection of the problem, determination of the data needed, collection and arrangement of data for presentation and exposition. Mr. Bachelder. Prereq.: Soc. 1 and 2, for majors in Sociology; without prerequisite for other students in Division of Social Science. 3 lec. or rec.; 3 cr.

84. METHODS OF SOCIAL PROGRESS. Efforts to improve social conditions and attain a larger measure of social justice; community experiments; development of modern social legislation; application of



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principles of insurance to social problems; various forms of mutual aids and philanthropy; endowments and special foundations. Mr. Coulter. Prereq.: Soc. 1 and 2. 3 lec. or rec.; 3 cr.

87. THE CHURCH IN AMERICAN SOCIETY. Contemporary organizations for worship in the community, their correlation, functions, and problems; the rise of the church and its relation to labor, the state, school, social welfare agencies, significance to the community of its organization and financing; church federation and union. Mr. Coulter. Prereq.: Soc. 1 and 2. 3 lec. or rec.; 3 cr.

88. RECREATION AND LEISURE. Problems arising from the increase of leisure time in modern society; typical leisure-time activities; theories of play; practical training programs in recreation; the functions of leadership; analysis of types and qualities of leadership as exhibited by typical leaders; the material and program of leadership training. Mr. Bachelder. Prereq.: Soc. 1 and 2. 3 lec. or rec.; 3 cr.

89, 90. DEVELOPMENT OF SOCIOLOGICAL THOUGHT. The history of Sociology Thought, with special reference to the writings of Comte, Spencer, and the later writers of the nineteenth century; a comparison of contemporary sociological systems. Mr. Coulter. Prereq.: Soc. 1 and 2. 89 prerequisite for 90. 3 lec. or rec.; 3 cr.

95, 96. SOCIOLOGICAL RESEARCH. A workroom course. Research projects will be set up in conference with the instructor and worked out individually or in groups. Emphasis is placed on techniques of gathering data and on presentation of the findings. Mr. Bachelder. Prereq.: 12 credits in Sociology including Soc. 75. 3 cr.

97, 98. SOCIAL SERVICE FIELD WORK. Designed to give the student an understanding of social work through observation and participation. Lectures, readings, and conferences will be offered during the college year. The field work requirement may be satisfied either during the college year in co-operation with neighboring social agencies or during the summer by eight weeks' work with other accredited social work institutions. The Department will arrange for a limited number of student summer placements with well-supervised settlements, correctional institutions, and case work agencies in Chicago, Cleveland, Pittsburgh, Boston, and other urban centers. It is strongly recommended that students who can qualify should acquire this experience in the summer following the Junior year. In most cases agencies offer no remuneration beyond living expenses. Mr. Coulter. Prereq.: 12 credits of work in Sociology. 3 cr.

107. SOCIAL TRENDS. A study of the nature of social change, media in which it takes place; facilitating or retarding factors; differential rates of change among institutions; social lag; contemporary American ameliorative movements looking toward the improvement

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of the working man; public welfare programs, social security and social legislation. Open to graduates. Mr. Coulter. Permission of the instructor. 3 lec. or rec.; 3 cr.

181, 182. READING AND RESEARCH IN SOCIOLOGY. With the consent of the instructor, a student prepared by training and experience to do independent work may register for a reading and research course. The student will undertake assigned problems and readings under the guidance of the instructor. Social Control, Mr. Coulter; Consumer Credit, Mr. Coulter; Social Disorganization, Mr. Bachelder; Research Technique, Mr. Bachelder.

### ZOOLOGY

C. FLOYD JACKSON, *In Charge*

(See ZOOLOGY under BIOLOGY, after section on BOTANY.)



