

BULLETIN

*of the University of
New Hampshire*

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GRADUATE SCHOOL
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The Catalogue Issue of the Summer Session
The Catalogue Issue of the Graduate School
and other publications of the University of New Hampshire

CALENDAR FOR COLLEGE YEAR

1949 SUMMER SESSION

July 5	Tuesday	Summer School Registration
July 9	Saturday	Classes meet to make up day lost on July 4
Aug. 12	Friday	Summer Session closes

FIRST SEMESTER 1949-50

Sept. 20	Tuesday	Orientation Week begins
Sept. 26	Monday	Registration Day
Sept. 27	Tuesday	Classes begin at 7:30 A.M.
Oct. 4	Tuesday	University Day — no afternoon classes
Nov. 8	Tuesday	Mid-Semester Reports to be filed, 5 P.M.
Nov. 23	Wednesday-	Thanksgiving Recess — Wednesday, 12 noon,
Nov. 29	Monday	to Monday, 7:30 A.M.
Dec. 17	Saturday	Christmas Recess begins at 12 noon

1950

Jan. 3	Tuesday	Christmas Recess ends at 7:30 A.M.
Jan. 21	Saturday	Preparation Day, no classes
Jan. 23	Monday-	Examination Period
Feb. 2	Thursday	

SECOND SEMESTER

Feb. 6	Monday	Classes begin at 7:30 A.M.
Feb.	Friday-	Winter Carnival — no classes Friday, 1 P.M., to
	Saturday	Monday, 7:30 A.M.
March 14	Tuesday	Town Meeting, classes excused 10 A.M. to 1 P.M.
March 28	Tuesday	Mid-Semester Reports to be filed, 5 P.M.
April 1	Saturday	Spring Recess begins at 12 noon
April 10	Monday	Spring Recess ends at 7:30 A.M.
May 27	Saturday	Examinations begin
May 30	Tuesday	Memorial Day, holiday
June 9	Friday	Examinations end
June 11	Sunday	Commencement
June 17-18	Saturday-	Alumni Weekend
	Sunday	

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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 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 an approved 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 a 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 if 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.

Registration. A student who desires 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. The application should be accompanied by two official transcripts of undergraduate work or one official transcript and an accurate copy. A student's program of courses must be approved by his adviser and the Dean.

Tuition.* The tuition fee is \$200 a year for residents of New Hampshire, and \$450 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 \$7.50 per credit hour, if a resident, and \$16.25, if a non-resident. A Graduate Assistant registering for 9 credits or less shall pay \$3.75 per credit hour, and if registered for more than 9 credits shall pay \$100 per year.

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

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 20 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 Summer Sessions in the University of New Hampshire, the following variations are permissible: The time occupied in earning 6 credits elsewhere at approved graduate work 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 extramural 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 department's requirements in this matter must be approved by the Executive Council.

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 from the time of registration for the first work taken to be counted for the degree.

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).

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 three, including the instructor under whose direction the paper has been written, and two other members selected jointly by the Chairman of the Department and the Dean of the Graduate School. The candidate must file with the Executive Council, for its approval, a statement of the subject of the thesis 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 by the committee on the thesis.

Thesis Credits. The number of thesis credits may vary from 6 to 10, subject to the approval of the major department.

Thesis Regulations. All theses 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 Education

Master of Arts

Master of Science

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 two weeks before Commencement, together with a receipt for the binding free 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 \$60, \$80, and \$100 per month, depending upon the student's program of hours of study and hours of service. Inquiries regarding Assistantships should be addressed to the Chairman 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 these 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.

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 \$15 to \$30 per month.

Board. The University operates on a self-service basis a modern, well-appointed dining hall. Regular weekly board and cafeteria service are provided.

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. (The University reserves the right to withdraw any course offering.)

Agricultural and Biological Chemistry

THOMAS G. PHILLIPS, *Chairman*

Students majoring in this Department are expected to have had preparation in the Biological Sciences, in Mathematics, in Physics, and in General, Analytical, 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 labs.; 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. Shirmer. Prereq.: Satisfactory preparation in Organic Chemistry and Quantitative Analysis. 1 lec.; 3 lab.; 4 cr.

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 Purinton, Mr. Teeri. Prereq.: Satisfactory preparation in Analytical, Organic, and Biological Chemistry. Subject matter and credits to be arranged.

Agricultural Economics

HARRY C. WOODWORTH, *Chairman*

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, including 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 Chairman of the Department.

56. Agricultural Marketing. The market structure responsible for the distribution of agricultural products will be reviewed briefly. Primary emphasis will be placed on the theory of price determination, public and private administration of prices, and analysis of agricultural prices. Mr. Bowring. 3 lec. 3 cr.

60. 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.

67-68. 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. Burkett. 3 cr.

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.

107. Advanced Statistics for Agriculture. Use of statistical tools in measurement and analysis of data. Assigned problems and conferences. Mr. Bowring. 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 guidance of the instructor.

Agronomy

FORD S. PRINCE, *Chairman*

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 1949-50.)

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. Feuer. Prereq.: Agron. 1, and other courses at the discretion of the instructor. 2 lec.; 1 lab.; 3 cr. (Alternate years; not offered in 1949-50.)

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: not offered in 1949-50.)

60. Soil Conservation. The causes and effects of soil erosion. Cropping systems, fertilizer practices, and structural devices used in erosion control. Mr. Feuer. Prereq.: Agron. 1, 4, 10. 1 lec.; 2 lab.; 3 cr. (Alternate years; not offered in 1949-50.)

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. 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.

103. Advanced Soil Fertility. Lectures, discussions, problem work in the laboratory and greenhouse.

Discussion of theories concerning nutrient availability and fixation. Use of biological methods for major and minor nutrient assays. Principles of experimental design in field plots. Prereq.: Agron. 59 and Agr. Chem. 54 or Chem. 22. Mr. Kardos. 3 cr.

104. Advanced Soil Chemistry. Lectures, discussions, and problem work in laboratory.

Physical chemistry of soils, soil colloidal phenomena. Anion and cation exchange mechanisms in soils. Theories of swelling. Crystallographic properties of the clay colloids and their relation to cation and anion exchange. The nature of soil acidity. Oxidation — reduction phenomena in soils. Prereq.: Agron. 59 and Agr. Chem. 54 or Chem. 22. (Chem. 82 or 84 recommended.) Mr. Kardos. 3 cr.

Animal Industry

KENNETH S. MORROW, *Chairman of Dairy Husbandry*

LORING V. TIRRELL, *Chairman of Animal Husbandry*

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

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.: A. H. 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.

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.: D. H. 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.

Bacteriology

LAWRENCE W. SLANETZ, *Chairman*

Students majoring in Bacteriology are expected to have had preparation the Biological and Physical Sciences and in the basic courses 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. Slantez and members of the staff. Credits to be arranged.

57, 58. Bacteriology Seminar. Reports and discussions on current literature and recent development in Bacteriology. Mr. Slantez 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. 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. Slantez, Prereq.: Bact. 2 or 8 or equivalent. 2 lec.; 2 cr.

Biology

GEORGE M. MOORE, *Chairman*

Students who wish to secure a Master's Degree in Biology must have completed an undergraduate Major in Biology or in some field of the Biological Sciences. Suitable training in the Physical Sciences is also necessary. Students lacking undergraduate training in any of the fields of the Biological Sciences may be required to complete certain courses in these fields which do not carry graduate credit before they are admitted to candidacy for a degree.

Graduate work in Biology is under the direction of a committee consisting of the chairmen of the Departments of Bacteriology, Botany, Entomology, and Zoology. This committee shall determine, in light of the student's objectives, the courses and requirements to be met by the candidate. Candidates for the Master's degree in Biology shall pass an oral examination covering (1) their general preparation in the field; (2) their graduate and undergraduate courses in the Biological Sciences; and (3) thesis.

91. Biology-Education. Problems in the Teaching of High School Biology. Objectives and methods of teaching. The selection and organization of materials; visual aids; setting up aquaria and other projects will be stressed. Mrs. Milne. Prereq.: Two years of Biological Science and Ed. 61. 2 rec.; 1 lab.; or field trip; 3 cr.

For listings of other courses see: Bacteriology, Botany, Entomology and Zoology.

Botany

ALBION R. HODGDON, *Chairman*

Students who desire a Master's Degree in Botany are expected to have had adequate preparation in basic Botany courses and in the Physical Sciences.

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.: Botany 6. Hours to be arranged. 4 cr.

57, 58. Problems in (a) Systematic Botany (b) Plant Physiology, (c) Plant Pathology, and (d) Plant Anatomy and Cytology. Elective only upon consultation with Chairman of Department. Mr. Hodgdon, Mr. Dunn, Mr. Richards, and Miss Nast. Hours to be arranged. 2 to 6 credits.

102. Advanced Plant Ecology. Requirements for growth; specialization and adaptation; geographic and physiographic relations. Regional floras. Interpretation and classification of habitat. Special problems are assigned. Mr. Hodgdon. Incidental lectures, laboratory, and field work. 4 cr.

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.

104. Histological Techniques. A methods course in embedding, sectioning, and staining plant tissues, and preparation of toto mounts. Miss Nast. Prereq.: Bot. 1 or Bot. 3. 3 cr. (offered in 1951, in alternate years with Botany 12).

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.

107-108. Problems in (a) Systematic Botany, (b) Plant Physiology, (c) Plant Pathology and (d) Plant Anatomy and Cytology. Elective only upon consultation with Chairman of Department. Mr. Hodgdon, Mr. Dunn, Mr. Richards, Miss Nast. Hours to be arranged. 2 to 6 credits.

Chemistry and Chemical Engineering

HAROLD A. IDDLES, *Chairman*

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.

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. Emphasis 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 spectography. Sufficient experience is obtained to allow the development of considerable skill in even the more complex methods. Prereq.: Chem. 22. 2 lec.; 2 lab.; 4 cr.

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 Economics. 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.

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.

79. Chemical Engineering Thermodynamics. A study of the fundamental laws of energy and their application to chemical engineering problems. Mr. Zimmerman. Prereq.: Chem. 84 and Chem. 74. 2 lec.; 1 rec.; 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. (Not offered in 1949-50.)

82. Pre-Medical and Pre-Dental Physical Chemistry. A brief review and survey of the more important fundamental topics of Physical Chemistry; thereafter, those topics of Physical and Theoretical Chemistry which have application in the medical, biological, and agricultural sciences. Mr. O'Loane. Prereq.: Chem. 2, Phys. 2 or 22, Math 6. 3 lec.; 3 cr.

83-84. Elementary Physical Chemistry. The properties of gases, liquids, and solids; thermochemistry and thermodynamics; solutions, chem-

ical equilibria, reaction rates, conductance and electromotive force. Mr. O'Loane Prereq.: Phys. 22. 3 lec.; 2 lab.; 5 cr.

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. Haendler. Prereq.: Chem. 84 or equivalent. 3 lec.; 3 cr.

87, 88. Chemical Literature and Seminar. Use of the Chemical Library; student reports on topics of interest. Mr. Atkinson. Prereq.: Chem. 62 and Chem. 48. 1 lec.; 1 cr.

89-90. Thesis. A thesis covering the related background and experimental observations of the year's investigation in some selected subject is required. Members of the staff. For Seniors in Chemistry, who have completed Chem. 48, 62, and 84. 5 lab.; 5 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 to 4 lab.; 3 to 5 cr.

116. Organic Chemistry Laboratory. Micro-Quantitative Analysis. The combustion for carbon and hydrogen, Dumas nitrogen, Kjeldahl 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. O'Loane. Prereq.: One year of Physical Chemistry. 3 rec.; 3 cr.

122. Physical Chemistry. Chemical Kinetics. A study of the 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 measurement of refractive index, molecular, rotation, activity co-efficients by vapor pressure, and E.M.F. methods, heterogeneous and homogeneous equilibrium constants, and kinetic constants. Mr. O'Loane. 1 lec.; 2 lab.; 3 cr.

131-132. Colloquium in Chemistry.

- a. Advanced Inorganic Chemistry, Mr. Haendler.
- b. History of Chemistry, Mr. Funkhouser.
- c. Organic Chemistry, Mr. Atkinson.
- d. Theoretical Organic Chemistry, Mr. Kuivila.

- e. Organic Chemistry, Mr. Iddles.
- f. Physical Chemistry, Mr. O'Loane.
- g. Analytical Chemistry, Mr.

3 lec.; 3 cr. Sections of the course may be taken to a total of 12 credits.

135. Unit Operations—Fluid Flow, Heat Flow, and Evaporation.

An advanced course dealing with the fundamental theory and applicants 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 and Mr.; *Inorganic Chemistry*, Mr. Haendler; *Organic Chemistry*, Mr. Iddles, Mr. Funkhouser, Mr. Atkinson and Mr. Kuivila; *Physical Chemistry*, Mr. O'Loane; *Chemical Engineering*, Mr. Zimmerman. Prereq.: Special permission. Credits to be arranged.

Civil Engineering

EDMOND W. BOWLER, *Chairman*

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 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.

The economics of location and design of highways and city streets; methods of construction, maintenance, and specifications governing the various types of surfaces. The administration and methods of financing of highway systems. Selected problems of location and design are studied in the laboratory. Mr. Skelton. Prereq.: C.E. 6 and 15. 2 rec.; 2 lab.; 4 cr.

62. Soil Mechanics and Foundation.

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 system; 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 analysis and design of steel and timber structures. Typical design problems include the plate girder, mill bent, bridge trusses and selected parts of building frames. Economy of design and the interpretation of various specifications are emphasized. 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, retaining walls and small bridges. 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. 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

JOHN A. HOGAN, *Chairman*

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; 20 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. Mr. Hogan. Prereq.: Econ. 2. 3 lec. or rec.; 3 cr.

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. (Given in alternate years; not offered in 1949-50.)

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. (Given in alternate years; not offered in 1949-50.)

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

56. Corporation Finance. Methods of financing corporate enterprise. Mr. Degler. Prereq.: Econ. 2. 3 lec. or rec.; 3 cr.

58. Principles of Investment. The general principles of investment. The problem of investment; investment characteristics of stocks and bonds; public utility, railroad, industrial, and government securities; protection of the investor; investment banking; and related problems. Mr. Degler. Prereq.: Econ. 2. 3 lec. or rec.; 3 cr. (Given in alternate years; offered in 1949-50.)

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. (Given in alternate years; not offered in 1949-50.)

64. Comparative Study of Economic Systems. An examination of socialism, communism, capitalism, and modifications of these types, particularly as exemplified by leading nations. Prereq.: Econ. 2 or permission of the instructor. Miss Woodruff. 3 lec. or rec.; 3 cr. (Given in alternate years; offered in 1949-50.)

74. The Economics of Contemporary American Business. The nature of business profits as molded by accounting; survey of the mechanisms yielding profits including producing and inventory accumulation, credit expansion, net capital formation, etc.; the effects of these upon inflation, the value of money, labor management problems, the desire for tariffs, business cycles, farm problems, high pressure selling, and other economic problems of the times; some evaluation of Neo-Classical and Keynesian schools of economic thought. Mr. Shafer. Prereq.: For Seniors majoring in Economics or Business and for Graduate Students, in each case by permission of the instructor. 3 lec. or rec.; 3 cr.

76. Value and Distribution. An advanced course in economic theory. Emphasis is upon the theory of price and the distribution of income. Mr. Shafer. Prereq.: Econ. 2. 3 lec. or rec.; 3 cr. (Offered in first semester of 1949-50.)

151, 152. Labor Seminar. Advanced study of labor markets, wage incentive systems, job evaluation, relation of wage policy to employment and problems raised by these and other factors in negotiating collective bargaining contracts. Collective bargaining studied as a means of establishing a system of industrial jurisprudence. Class discussion based primarily on case studies. Mr. Hogan. 3 lec. or rec.; 3 cr.

157-158. History of Economic Thought. A critical study of the development of economic concepts and ideas. Attention is given to the various schools of economic thought. Prereq.: 18 hours of major credit in economics and the consent of the instructor. 3 lec. or rec.; 3 cr. (Not offered in 1949-50.)

177. Institutionalism. The institutional approach in economic analysis; the theory of conflicts of interest, scarcity, and mutuality; theory of transactions; efficiency in relation to scarcity; futurity; habit and custom; sovereignty and legal foundations; reasonable value; some examination of the works of Locke, Hume, Velben, Common, Mitchell, Nourse, and others. Prereq.: 18 hours of major credits in Economics and the consent of the instructor. Mr. Shafer. 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; Economic Theory, Mr. Shafer; Labor Economics, Mr. Hogan.

Education

THOMAS O. MARSHALL, *Chairman*

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 30 credits must be earned. Each of the following courses, if not taken during undergraduate education, must be passed satisfactorily.

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

Students who meet the requirements given above are free to select, with the advice of the Chairman 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, (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. 2 or 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 institutes, 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. 2 or 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 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.: Permission of instructor; 2 or 3 cr.

65, (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, achievement, attitudes, and interests in the public-school program with particular emphasis upon the role of tests. Mr. Marshall. Prereq.: Educational Psychology. 2 or 3 cr.

76, (76). Philosophy of Education. A study of current educational objectives and practices and the philosophical foundations upon which they are based. Mr. Marshall. Prereq.: Ed. 42, 51, 52. 3 rec.; 2 ir 3 cr.

83, (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. Menge. 2 or 3 cr.

84, (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 attempts 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. Bretsch. 2 or 3 cr. (Not offered in 1949-50.)

87. Principles and Problems of Secondary-School Curriculum Reorganization. The course will be concerned with significant changes in secondary-school offerings, with special emphasis upon curriculum revision and techniques of revision. Mr. Koch. 2 or 3 cr.

89, (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. Carroll, Mr. Dittmer. Prereq.: General course in Psychology. 2 or 3 cr.

102, (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, princi-

pal, or department head. Emphasis will be placed upon the practical application of the following functions of public-school administration: policy making, management, personnel, public relations, fiscal, housing, curricular, reportorial, research. Pursuit of practical term projects will be encouraged as well as having experience in attacking problems in school administration as buildings, budget, evaluating school housing, developing a schedule, etc. Mr. Bretsch. 2 or 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 school. 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. (Not offered in 1949-50.)

114, (114). Workshop in Secondary-School Curriculum Development. 2 or 3 cr.

118, (118). Workshop in Problems of Organizations and Administration of Guidance. 2 or 3 cr.

122, (122). Problems in the Supervision of High-School Teaching. Consideration of the objectives of education, the objectives of supervision, and the role of the supervisor in studying and evaluating the whole learning situation constitute the bases for the course. Emphasis will be placed upon the study of pupil and teacher diagnosis, pupil and teacher improvement, school material, and evaluation of supervising practices. Designed for headmasters, superintendents, and the supervisors of cadet teaching. Mr. Bretsch. 2 or 3 cr.

125, (125). Educational Finance and Business Management. Aspects and principles of financing education, budgetary procedure, accounting, cost analysis, auditing school indebtedness, and financial reporting comprise the units to be studied. Experience in handling practical school finance problems will be part of the project work. Mr. Bretsch. Prereq.: Ed. 102 or equivalent in course or experience. 2 or 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

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

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 Prepreparation. 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. Mrs. Milne.

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.

History-Education (Hist-Ed) 91. Problems in the Teaching of High-School History. 3 cr.

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 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 Chairman 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.

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-Co) 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-Language (Ed-Lang) 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 or 3 cr.

84. Workshop in the Teaching of English in Upper Elementary Schools. This course will attempt to carry on a practical everyday approach to the teaching of various forms of English: creative 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 textbooks and theories of education only. 2 or 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 an 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. 2 or 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 of solving; diagnostic and remedial work; evaluating pupil accomplishment. Assigned readings and problems, discussions, demonstrations, and conferences with the instructor. 2 or 3 cr.

94. Workshop in Upper-Grade Language Arts and Techniques of Pupil Organization. 2 or 4 cr.

95. Workshop in Principles and Practices of Elementary Education. 2 or 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. Each student will be

encouraged to work out problems in relation to his teaching position. This course is intended for superintendents of schools, elementary supervisors or principals, or persons preparing for such positions. The demonstration class will be in 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

LEON W. HITCHCOCK, *Chairman*

To become a candidate for a Master's Degree in Electrical Engineering a student should have completed work in his major field equivalent to that required of undergraduates in this curriculum at the University of New Hampshire. The Department requires one additional copy of the thesis. (*See page 4.*)

55. Electrical Engineering. Transmission line fundamentals, T and Pi sections, and filters. Mr. Nulsen. Prereq.: E.E. 13. Required of Seniors in E.E. 3 rec.; 3 cr.

58. Radio and Wire Communication. Telephone measurements, long line measurements, oscillators, radio transmitters and receivers. Mr. Mace. Prereq.: E.E. 57. Elective for Seniors in E.E. 3 rec.; 1 lab.; 4 cr.

60. Advanced Circuit Theory. Steady state and transient analysis, derivation of fundamental formulas and constants. Mr. Nulsen. Prereq.: E.E. 55. Elective for Seniors in E.E. 3 rec.; 1 conference period; 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, or a series of original experiments. Mr. Nulsen. Prereq.: E.E. 25. Elective for selected Seniors in E.E. 4 lab.; 4 cr.

78. Advanced Electronics. Industrial electronics, control circuits and systems, special circuits, elements of servo-mechanisms. Mr. Mace. Prereq.: E.E. 57. Elective for Technology Seniors with permission of Department. 3 rec.; 1 lab.; 4 cr.

101, 102. Electric and Magnetic Circuits. A treatment of unbalanced circuits by the use of symmetrical components. Transformer and reactor analysis. Mr. Nulsen. 3 rec.; 3 cr.

103, 104. Propagation of Electro-Magnetic Waves. Antennas and wave guides. Mr. Mace. 3 rec.; 3 cr.

105. Advanced Communication. Circuit Theory. Mr. Mace. 3 rec.; 1 lab.; 4 cr.

Thesis. Credits to be arranged. Mr. Mace and Mr. Nulsen. 3-5 cr.

English

SYLVESTER H. BINGHAM, *Chairman*

A candidate for the degree of Master of Arts in English must present an academic record that shows he is prepared for advanced work in English and American 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. 3 lec.; 3 cr.

57, 58. Shakespeare's Plays. The major histories, comedies, and tragedies. Mr. Hennessy. 3 lec.; 3 cr.

59. Milton. Mr. Schultz. 3 lec.; 3 cr. (Given in alternate years; offered in 1949-50.)

60. Boswell's Johnson. 3 lec.; 3 cr. (Given in alternate years; not offered in 1949-50.)

61. Wordsworth. 3 lec.; 3 cr. (Given in alternate years; not offered in 1949-50.)

62. Browning. Mr. Daggett. 3 lec.; 3 cr. (Given in alternate years; offered in 1949-50.)

63, 64. English Literature in the Sixteenth Century. Mr. Schultz. 3 lec.; 3 cr. (Given in alternate years; offered in 1949-50.)

65, 66. English Literature in the Seventeenth Century. Mr. Towle. 3 lec.; 3 cr. (Given in alternate years; not offered in 1949-50.)

67, 68. English Literature in the Eighteenth Century. Mr. Maynard. 3 lec.; 3 cr. (Given in alternate years; offered in 1949-50.)

69, 70. The English Romantic Period. Wordsworth, Coleridge, Lamb; Byron, Shelley, Keats, Hazlitt, DeQuincy. Mr. Daggett. 3 lec.; 3 cr. (Given in alternate years; offered in 1949-50.)

71, 72. Victorian Prose and Poetry. Major non-fictional prose from Carlyle to Stevenson and major poetry from Tennyson to Hardy. Mr. Hennessy. 3 lec.; 3 cr. (Given in alternate years; not offered in 1949-50.)

73, 74. British Literature of the Twentieth Century. Mr. Daggett. 3 lec.; 3 cr. (Given in alternate years; not offered in 1949-50.)

75. New England Renaissance. Emerson, Thoreau, and other transcendentalists. 3 lec.; 3 cr. (Given in alternate years; not offered in 1949-50.)

76. American Novel in the Nineteenth Century. 3 lec.; 3 cr. (Given in alternate years; offered in 1949-50.)

77. American poetry of the Nineteenth Century. 3 lec.; 3 cr. (Given in alternate years; offered in 1949-50.)

78. American Humor. 3 lec.; 3 cr. (Given in alternate years; not offered in 1949-50.)

79, 80. American Literature of the Twentieth Century. Mr. Towle. 3 lec.; 3 cr. (Given in alternate years; offered in 1949-50.)

81-82. Introduction to English Drama. The development of English drama, exclusive of Shakespeare, from the Middle Ages to the present. Mr. Hennessy. 3 lec.; 3 cr. (Given in alternate years; offered in 1949-50.)

83-84. The English Novel of the Eighteenth and Nineteenth Centuries. Mr. Bingham. 3 lec.; 3 cr. (English 83 not offered in 1949-50.)

***85, 86. A Survey of English and American Literature.** The Department, under the direction of the Chairman. 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 1949-50.)

160. Boswell's Johnson. 3 lec.; 3 cr. (Given in alternate years; not offered in 1949-50.)

161. Wordsworth. 3 lec.; 3 cr. (Given in alternate years; not offered in 1949-50.)

162. Browning. 3 lec.; 3 cr. (Given in alternate years; offered in 1949-50.)

163, 164. English Literature in the Sixteenth Century. 3 lec.; 3 cr. (Given in alternate years; offered in 1949-50.)

165, 166. English Literature in the Seventeenth Century. 3 lec.; 3 cr. (Given in alternate years; not offered in 1949-50.)

167, 168. English Literature in the Eighteenth Century. 3 lec.; 3 cr. (Given in alternate years; offered in 1949-50.)

169, 170. The English Romantic Period. 3 lec.; 3 cr. (Given in alternate years; offered in 1949-50.)

171-172. Victorian Prose and Poetry. 3 lec.; 3 cr. (Given in alternate years; not offered in 1949-50.)

173, 174. British Literature of the Twentieth Century. 3 lec.; 3 cr. (Given in alternate years; not offered in 1949-50.)

175. The New England Renaissance. 3 lec.; 3 cr. (Given in alternate years; not offered in 1949-50.)

**This course cannot be counted toward the Master's degree.*

176. The American Novel in the Nineteenth Century. 3 lec.; 3 cr. (Given in alternate years; offered in 1949-50.)

177. American Poetry of the Nineteenth Century. 3 lec.; 3 cr. (Given in alternate years; offered in 1949-50.)

178. American Humor. 3 lec.; 3 cr. (Given in alternate years; not offered in 1949-50.)

179, 180. American Literature of the Twentieth Century. 3 lec.; 3 cr. (Given in alternate years; offered in 1949-50.)

181, 182. An Introduction to English Drama. 3 lec.; 3 cr. (Given in alternate years; offered in 1949-50.)

183, 184. The English Novel of the Eighteenth and Nineteenth Centuries. 3 lec.; 3 cr. (Engl. 183 not offered in 1949-50.)

Entomology

JAMES G. CONKLIN, *Chairman*

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 who are interested in public health or medicine. Mr. Blickle. 2 lec.; 1 lab.; 3 cr.

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. Prereq.: 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 Chairman 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 Chairman 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. Thesis. Mr. Conklin, Mr. Blickle. Hours and credits to be arranged.

Government

NORMAN ALEXANDER, *Chairman*

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 and other requirements prescribed by the Graduate School.

The requirements for a Master's Degree in Government are: (1) 12 credits of work in courses numbered over 100, of this total 6 credits may be earned by the thesis requirement; (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.

51,52. Constitutional Law. A case study of the American Constitution, stressing the powers of Congress and the President. The Bill of Rights, 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. 3 lec. or rec.; 3 cr.

55. World Politics. The nature of the international community and the foundations of national power. An analysis of the major forces which influence contemporary world politics, including nationalism, imperialism, international economics, population problems, ideological differences, and the techniques of total war. Emphasis is placed on the critical areas in the present East-West power struggle, including the Far East, the Near East, and Western Europe. Mr. Kuusisto. 3 lec. or rec.; 3 cr.

56. International Law and Organization. This course has a double aim: to analyze the rules governing the conduct of states and to examine existing international organizations, both within and outside the United Nations. An analysis of the United Nations and its subsidiary organizations, as well as the defunct League of Nations and its agencies, is made in terms of their effectiveness in bringing law and order to the international community. The policies of the Great Powers toward major issues of both international law and organization are examined. Mr. Kuusisto. 3 lec. or rec.; 3 cr.

57. Public Administration. An examination of concepts and relationships involved in getting the job done in government. Material covers the expansion and present scope of government administration; the enlarged responsibility to the public which rests upon the modern administrator; organization, co-ordination, and planning as tools of management; personnel, finance, and other selected administrative techniques. Mr. Deming. Prereq.: Permission of instructor. 3 lec. or rec.; 3 cr.

58. Problems of Public Administration. An extension of the theory and techniques of Govt. 57 as applied in the operating areas of administrative practice. Material includes an appraisal of bureaucracy and the function of administration in a democracy; the chief types of administrative organization; the administrative process: administrative procedure, management, analysis, control and responsibility. Mr. Deming. Prereq.: Govt. 57. 3 lec. or rec.; 3 cr.

60. Government Apprenticeship. Designed to give the student a practical concept of local and state governmental administration. At least two afternoons a week will be spent working under the supervision of a public official in a unit of state or local government. The student will be assigned to the Bureau of Government Research service projects which are designed to assist the public official under whom the student is working. The student will be expected to acquaint himself with the instructional materials available in his field of apprenticeship. Periodic reports will be required. Mr. Deming. Prereq.: Govt. 57 and permission of the instructor. 4 cr.

61. Labor Law. An analysis of the development and the interpretation of the major laws regulating labor. The principal topics deal with legislation relating to the legal position of labor unions; the policies of organized labor; unfair labor practices by employers and employees; collective bargaining; democracy within labor unions. Consideration is given to the economic and political effects of such legislation upon labor and management and to the impact of labor laws upon the ideal of the democratic process. Mr. Alexander. 3 lec. or rec.; 3 cr.

63. Political Thought in the West. A survey of the principal political theories from Plato and Aristotle to the beginning of the modern liberal tradition. The course is designed to show the growth and development of political thinking and institutions in terms of the development of modern government. Special emphasis will be given to the development of the modern nation state and to its fundamental institutions. Mr. Holden. 3 lec. or rec.; 3 cr.

64. Modern Political Thought. A survey of modern Western political thought from the emergence of the nation state to the present. Special attention will be given to the meaning and growth of the basic patterns of thought on the Continent and in England, including liberalism, democracy, socialism, communism, fascism, and nazism. American political thought will be traced from its English and European origins, stressing the more modern developments in Federalism, judicial review, centralization, separation of powers, etc. Mr. Holden. 3 lec. or rec.; 3 cr.

65, 66. Research in Government Problems. An individual research project in one of the fields of government, *e.g.*; Local or State Administration, Comparative Government, International Relations, International Organization, Political Theory, Politics, or Public Law to be prepared under the direction of a member of the staff. Emphasis will be placed on the methods and sources of research in government. The Department staff. 3 cr.

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. Mr. Kuusisto. Prereq.: Permission of the instructor.

108. Seminar in Public Management. A study of special management and administrative problems through use of individual research on specific problems, round-table discussions with public officials, and individual conferences. Attention will be given to problems of municipal management as well as to state and federal administration. Mr. Deming. Prereq.: Permission of the instructor. 3 cr.

110. Administrative Law. A study of the legal status of public officers; the procedures of administrative authorities and agencies; the scope and limitations of administrative powers; the enforcement of administrative decisions; and the remedies against administrative action. Mr. Alexander. Prereq.: Permission of the instructor. 3 cr.

History

PHILIP M. MARSTON, *Chairman*

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 Freshman, with a grade of C or better. The two undergraduate courses recommended are History 7, 8. History of the United States, and History 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 Freshman.

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. 3 lec. or rec.; 3 cr. (Given in alternate years; not offered in 1949-50.)

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. 3 lec. or rec.; 3 cr. (Given in alternate years; offered in 1949-50.)

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. 3 lec. or rec.; 3 cr.

71, 72. History of Russia. A study of Tsarist Russia, 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. 3 lec. or rec.; 3 cr.

83,84. The Foreign Relations of the United States. Although primarily a study in the history of American diplomacy, as much attention as possible is given to the non-diplomatic aspects of foreign relations. Mr. Long. 3 lec. or rec.; 3 cr. (Given in alternate years; not offered in 1949-50.)

85, 86. Twentieth Century America. A study of the history of the United States since 1890. Emphasis is placed on economic discontent and political protest from the Populist Revolt to date; and on the world conditions changing and molding United States foreign policy. Mr. Long. 3 lec. or rec.; 3 cr. (Given in alternate years; offered in 1949-50.)

87, 88. The Intellectual History of Western Civilization. The history of ideas and of great epochs in human thought. A study of the domi-

nant 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 a study of some of the major source writings of each period. Mr. Johnson. 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; teaching and testing techniques which may be advantageously used in teaching high-school history and other social studies; experiments in studying and teaching history. Mr. Long. 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. (Given in alternate years; offered in 1949-50.)

113, 114. Sources for the Study of Colonial American History. For students who have taken Hist. 51, 52 or 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. (Given in alternate years; not offered in 1949-50.)

123, 124. Historiography. The lives and writing of some leading historians 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 1949-50.)

Horticulture

ALBERT F. YEAGER, *Chairman*

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.

53. Pomology: Orchard Fruits. Fundamental principles and experimental data and their applications to orchard problems including the establishment of orchards, soil management, water and fertilizer requirements, mineral deficiencies, training and pruning, fruit bud formation, pollination and fruits setting, thinning and winter injury. Mr. Latimer. 3 lec.; 3 cr.

54. Pomology: Small Fruit Culture. The culture and economic uses of the strawberry, raspberry, blackberry, blueberry and grape. Each fruit is considered with relation to its history, propagation, planting, pruning, harvesting marketing, insects and diseases, and domestic uses. Mr. Latimer. 2 lec.; 2 cr.

55. Systematic Survey of Fruits. Important species 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 lec.; 2 cr.

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. 2 lec.; 2 cr.

58. Ericacious Fruits. A course designed to cover both highbush and lowbush blueberries and cranberries, including culture, propagation, harvesting, and marketing. For majors in Horticulture. W. W. Smith. 2 lec.; 2 cr.

65. Commercial Vegetable Production. The management of commercial vegetable gardens. Important vegetables and their culture including a comprehensive review of recent experimental work. 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 are required to prepare and present papers on selected topics. Department staff. For Seniors and Graduate Students in Horticulture. Others by permission of Department Chairman. Mr. Smith. 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. 2 lec.; 1 lab.; 3 cr.

101-102. Methods of Plant Research. A study of the methods used in laboratory and field in plant investigations including scientific equipment such as potentiometers, thermocouples, geiger counters, refractometers, spectrophotometers etc., and their use; project outlines, bibliographies, procedures, interpretation of data and statistical analysis of results. Mr. Eggert and staff. Prereq.: Ag. Chem. 2. 2 rec.; 2 cr. each semester.

103. Nutrition of Horticultural Plants. The effect of soil management, fertilizers, mulching materials, and mineral deficiencies on the functioning and performance of horticultural plants. Mr. Latimer. Prereq: Bot. 4, Ag. Chem. 2; 2 rec.; 2 cr.

104. Asexual Propagation of Plants. The making, dissection, and critical examination of grafts, buds, cuttings, and layers of clons, especially as applied to fruit stocks. A study of regeneration, orientation and compatibility of plant tissues. Mr. Smith. Prereq.: Ag. Chem. 2, Bot. 4. 2 rec.; 2 cr.

105. Flower Bud Formation, Pollination and Fruit Setting. The influence of natural environmental factors, soil management, orchard fertilization, and resultant chemical composition of fruit plants on flower bud formation and alternate bearing; also, the effect of these and genetical factors on the production of fruit. Mr. Latimer. Prereq: Ag. Chem. 2, Bot. 1-2, Zool. 49. 2 lec., 1 lab.; 3 cr.

109. Inheritance in Horticultural Plants. Inheritance in various horticultural crops, a review of literature, and an analysis of the future breeding possibilities of each crop. Mr. Yeager. Prereq.: Elementary genetics and plant breeding. 3 lec.; 3 cr.

Languages

CLIFFORD S. PARKER, *Chairman*

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 1949-1950).

Lang. 73-74. General Introduction to the Science of Language. An introduction to the science of linguistics. The origins of language; the languages of the world, phonology; morphology; syntax; semantics; etymology; 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 1949-1950).

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. Boulay.

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. (Not offered in 1949-50).

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. Parker. (Not offered in 1949-50.)

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. Faulkner.

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. (Not offered in 1949-50.)

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. Boulay.

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 Chairman 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. Moliere 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.: 18 credits in undergraduate courses in French Literature. 3 cr. Mr. Faulkner.

German

51-58. Modern German Literature. The works of Grillparzer, Hebel, Ludwig, Keller, Meyer, Hauptmann, Suderman, as well as those of other authors whose activity extends to the present time. Prereq.: German 4. 3 rec.; 3 cr. Mr. Lepke.

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. (Not offered in 1949-50).

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 1949-50.)

55-56. Literature and History. A comprehensive view of Latin Literature of the Golden Age, particularly the works of Caesar, 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. (Not offered in 1949-50.)

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 1949-50.)

125, 126. Latin Literature. A study of Latin Literature through the medium of selections from the works of the more important authors from the beginning 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

55-56. Latin-American Literature. Selected writers of Latin-American countries who illustrate literature and social conditions in Central and South America. Certain works will be discussed in class while others will be assigned for collateral reading. Prereq.: Spanish 4. 3 rec.; 3 cr. Mr. Berzunza. (Not offered in 1949-50.)

101, 102. Spanish Literature of the Middle Ages. Masterpieces and writers of Spanish Literature from the beginning 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

WILLIAM L. KICHLIN, *Acting Chairman*

Students majoring in this Department must have had not less than 30 semester credits in college Mathematics with an average of not less than 13, inclusive of a standard course in Differential Calculus, Integral Calculus, and Differential Equations.

51-52. Differential Equations. Ordinary and partial differential equations, Fourier series, and applications. Prereq.: Math. 18. 3 rec.; 3 cr.

54. Vector Analysis. Vector and scalar algebra and geometry, differentiation and differential operators, applications to electrical theory and to mechanics, dynamics, and hydro-dynamics. Prereq.: Math. 18. 3 rec.; 3 cr.

55-56. Advanced Plane and Solid Analytic Geometry. Prereq.: Math. 18. 3 rec; 3 cr.

57. History of Mathematics. A historical background and an appreciation of the development of various fields of Mathematics. Designed especially for those preparing to teach Mathematics in high school. Mr. Sewell. Prereq.: Math. 17. 3 rec.; 3 cr.

63-64. Statistical Methods. A continuation of Math. 43-44 including a more thorough study of correlation, sampling, tests of significance. Prereq.: Math. 44. 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 functions and groups of substitutions. Prereq.: Math. 18. 3 rec.; 3 cr.

91. Mathematics-Education (Math-Ed). The aims and values of secondary-school mathematics; the recommendations of the national committee on mathematics requirements, and the State Board requirements; the subject matter and the sequence in which it should be presented in both junior and senior high schools; techniques and instructional aids used in teaching secondary-school mathematics; errors, testing program, remedial teaching. Students preparing to teach mathematics in high school should register for this course; it is a prerequisite for Supervised Teaching in Mathematics. Lectures, assigned readings, and discussions. Mr. Perkins. Prereq.: Ed. 61 and Math. 16. 3 rec.; 3 cr.

101-102. Complex Variable. The theory of analytic functions of a single complex variable by the methods of Cauchy (integrals), Riemann (derivatives) and Weierstrass (series); conformal mapping and Riemann surfaces; and the elementary theory of elliptic functions. Mr. Harvey. Prereq.: Math. 51. 3 rec.; 3 cr.

103-104. Real Variable. The real number system, the theory of point sets, Lebesgue integration, the Riesz-Fischer theorem, functions of bounded variation, and other selected topics. Prereq.: Math. 51. 3 rec.; 3 cr.

105-106. 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 of mapping. Mr. Giddings. Prereq.: Math. 18. 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; and divergent series. Prereq.: Math. 51. 3 rec.; 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 T. DONOVAN, *Chairman*

To become a candidate for a Master's Degree in Mechanical Engineering a student should have completed work equivalent to that required for a B.S. degree in the field, at the University of New Hampshire, and should have maintained an average grade of B for his undergraduate course. The Department requires one additional copy of the thesis. (*See page 4.*)

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. Engineering Economy. The principles which form the basis of engineering procedures for obtaining the highest ratio of utility to cost. Prereq.: Senior standing. 3 rec.; 3 cr.

66. Industrial Management. Principles and methods of industrial management, designed to give students a working knowledge of modern industrial practice, with particular emphasis on the engineering viewpoint. Prereq.: Senior standing. 3 rec.; 3 cr.

101, 102. Advanced Thermodynamics. The general equation 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.

Physics

FREDERIC A. SCOTT, *Chairman*

For admission to graduate work in physics the candidate must have satisfactorily completed undergraduate courses in Physics totaling 24 to 30 semester hours. Suitable undergraduate work in mathematics is essential and should include work in differential equations. The general aim of the program will be to give the student broad general training in fundamentals. To accomplish this some intermediate courses numbered 50-99 may be required. The Department requires one additional copy of the thesis. (*See page 4.*)

81. Optics. Geometrical and physical optics, refraction, lens systems, wave theory of light, diffraction, interference, polarization, etc., spectroscopy. Prereq.: Phys. 21-22; Math. 51 passed or taken concurrently. 3 rec.; 1 lab.; 4 cr.

82. Heat. Thermometry, pyrometry, calorimetry, radiation, heat conduction and thermodynamics. Prereq.: Phys. 21-22; Math. 51-52 passed or taken concurrently. 3 rec.; 1 lab.; 4 cr.

83-84. Theory of Electricity and Magnetism. Electrostatics, magnetostatics, dielectric theory, electromagnetics, magnetic circuits, alternating currents, complex impedance, thermoelectricity, electromagnetic field. Prereq.: Phys. 21-22; Math. 51-52 passed or taken concurrently. 3 lec.; 1 lab.; 4 cr.

86. Advanced Mechanics. An analytical treatment of classical mechanics including such topics as the methods of plane statics and dynamics and their applications, impulsive forces, oscillations, statics and dynamics in space. Prereq.: Math. 51-52 passed or taken concurrently. 3 rec.; 3 cr.

91-92. Modern Physical Theories. Recent developments in Physics, including Maxwell's field equations, photoelectric effect, quantum theory, X-rays, relativity, nuclear theory. Prereq.: Phys. 83-84 or the equivalent. 3 rec.; 3 cr.

93-94. Theoretical Physics. An introduction to the applications of mathematics to physics, including such topics as kinetic theory, elasticity, fluid mechanics, sound, theory of vibrations, etc. Prereq.: Math. 51 and 52. 3 rec.; 3 cr.

95-96. Advanced Laboratory. Laboratory work of research type. Special problems are assigned to student who is placed on his own initiative. Prereq.: Senior standing in Physics in College of Technology. 2 lab.; 2 cr.

97. Electrical Discharge Through Gases. Properties of gaseous ions, electron theory, mobility, ionization and resonance potentials, vacuum tube phenomena, etc. Prereq.: Phys. 83-84. 3 rec.; 1 lab.; 4 cr.

99. Special Topics. A course designed to cover any selected topics not sufficiently well covered in a general course. Prereq.: Math. 51-52 passed or taken concurrently. Senior standing in Physics in College of Technology. 1, 2 or 3 cr.

151-152. Theoretical Physics. Methods of mathematical and theoretical physics applied to mechanics, hydrodynamics, dispersion theory, etc. 3 hrs. credit per semester.

153-154. Electromagnetic Theory. A discussion of classical electromagnetic theory covering a text such as Jeans or Page and Adams. 3 hrs. credit per semester.

155-156. Nuclear Physics. Theoretical and experimental aspects of nuclear processes. 3 hrs. credit per semester.

157. Quantum Mechanics. A brief description of present theory with application to simple problems. 3 hrs. credit.

158. Thermodynamics. A theoretical course to classical thermodynamics. 3 hrs. credit.

159. Special Topics. Any special fields of study not covered by the above graduate courses will be included in this course. Choice of topic to be determined by class. 1, 2, or 3 hours credit per semester. May be taken more than once.

161-162. Investigation and Research. Theoretical or experimental investigation of a problem in Physics. 6 hrs. cr.

163-164. Seminar. Reports on recent researches and investigations in the various fields of Physics. Required of all majors and Graduate Students in Physics. No credit.

Poultry Husbandry

Chairman (to be appointed)

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. Corbett, Mr. Ringrose, Mr. Hess. 1 to 3 cr.

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. 2 rec.; 1 lab.; 3 cr. (Alternate years. Offered in 1949-50.)

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 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. 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, Chairman

Students who plan to do their Master's work in Psychology must have had a minimum of 12 credits in undergraduate courses in Psychology. In general, it is not desirable for a student to attempt to earn a Master's Degree in Psychology at the University of 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.

52. Psychology of Adolescence. An examination of the physical, psychological, and social development of the individual during the period between childhood and maturity, and the implications for the individual, parent, teacher, and community of the problems characteristic of this period. Mr. Dittmer. Prereq.: Psych. 2. 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.

63. Individual Differences. A study of individual differences with special emphasis on intellectually gifted and mentally subnormal children. Mr. Bower. Prereq.: Psych. 2. 3 lec.; 3 cr.

67. Statistics in Psychology. A study of the problems and methods involved in the statistical treatment of quantitative data in psychology. Both the computation and interpretation of elementary statistical measures will be stressed. Mr. Dowd. Prereq.: Psych. 2. 3 lec.; 3 cr.

74. Psychology of Personality. A scientific approach to the analysis of personality in terms of structure, development, classification, and methods of measurement. Mr. Dittmer. Prereq.: Psych. 2. 3 lec.; 3 cr.

78. Physiological Psychology. A study of the organic bases of behavior. Psychologically relevant topics concerning the nervous system, endocrine glands, sense organs, etc., will be considered. Mr. Haslerud. Prereq.: Psych. 2. 3 lec.; 3 cr.

83. Systematic Psychology. A critical examination of the points of view of the various schools of psychology. Considerable attention is given to the contributions which the more important of these schools have made to contemporary thought in psychology. Mr. Dittmer. Prereq.: Psych. 2. 3 lec.; 3 cr.

98, (98). Seminar in Psychology. An extensive term paper on subjects chosen by the individual students. This project in library research meets the Department's requirement for a comprehensive paper. Mr. Carroll. Prereq.: 15 semester credits in Psychology. 3 cr.

105, (105). Clinical Psychology. A study of procedures in the diagnosis and therapy of behavior disorders. Directive and non-directive methods in psychotherapy are compared and critically evaluated. Emphasis is placed on Rogers non-directive approach. Some attention is given to the administration and interpretation of personality inventories. Mr. Carroll. Prereq.: 12 credits in Psychology including a course in mental hygiene or its equivalent. 3 cr.

106. Clinical Problems. Attention is concentrated on actual cases. In addition to a study of reports on individuals with behavior disorders, opportunities are provided for field work. Mr. Carroll. Prereq.: Psych. 105 or its equivalent and consent of the instructor. 3 cr.

110. Techniques of Counseling. A study of the psychological factors, techniques, and procedures involved in the analysis of the individual's vocational, educational, and social adjustments. Mr. McIntire. Prereq.: A course in statistics and permission of the instructor. 3 lec.; 3 cr.

114. Statistical Problems in Psychology. Advanced study of techniques for analyzing and interpreting experimental and testing problems, including psychophysical methods and factor analysis. Mr. Haslerud. Prereq.: Psych. 67 or its equivalent. 3 lec.; 3 cr.

117. Occupational Information. The intent of this course is to provide prospective counselors with a basis for understanding and interpreting the job needs, job requirements, and the job possibilities of their own communities. The content includes: material on sources and methods of obtaining occupational information, conducting an occupational survey; preparation of job descriptions and job specifications; development and use of job families; the Dictionary of Occupational Titles; occupational trends and opportunities. Field studies are required. Mr. Dittmer. Prereq.: Permission of the instructor. 3 cr.

121. Group Testing. Demonstration and experience in the administration and interpretation of group tests of personality, interests, achievement, capacity, and aptitude. Students will be required to do field work in testing. Mr. McIntire. Prereq.: Psych. 67 or equivalent and consent of the instructor. 3 cr.

122. Individual Testing. Demonstrations and experience in the administration and interpretation of individual tests. Detailed study will be made of the Terman-Merrill Revision of the Binet-Simon Scales and the Wechsler-Bellevue Intelligence Scales. Students will be required to purchase testing materials and to do field work in testing. Mr. McIntire. Prereq.: Psych. 121 or equivalent and consent of the instructor. 3 cr.

131, 132. Graduate Seminar. By lectures, readings in source materials (primarily current psychological journals), and reports, the student is directed in a critical examination of psychological theory and practice and in a synthesis of psychological knowledge. At least one semester required for Master's Degree in Psychology. Mr. Haslerud in charge. Prereq.: Permission of the instructor. 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 this 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.

Sociology

RAYMOND E. BASSETT, *Chairman*

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 Chairman 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) com-

pleted: 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 have written 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 treatment, the "honor system," limited self-government, parole and probation, and the juvenile court 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. An Introduction to Social Work and Public Welfare. The nature of social work; history of social work; contrasting techniques of family welfare, child welfare, group work, medical and psychiatric social work; public assistance programs (Old Age Assistance, Aid to Needy Blind, Aid to Dependent Children); direct relief; Social Security legislation; intergovernmental relationships and responsibilities; the organization and administration of public welfare in the State of New Hampshire. Mr. Moss. 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 to 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. Bassett. 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 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 function of leadership; analysis of types and qualities of leadership as exhibited by typical leaders; the material and program of leadership training. Mr. Moss. Prereq.: Soc. 1 and 2. 3 lec. or rec.; 3 cr.

89-90. Development of Sociological Thought. The history of sociological 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. Moss. Prereq.: Soc. 1 and 2. 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. Bassett. 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 of the lot of the working man; public welfare programs; social security and social legislation. 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. Bassett; Social Disorganization; Research Technique. 3 cr.

Zoology

GEORGE M. MOORE, *Chairman*

Students who wish to secure a Master's Degree in Zoology must have completed their basic undergraduate preparation in some field of the Biological Science with at least two years' work in Zoology. Suitable training in Botany, Chemistry, and Physics is also necessary. Students lacking these requirements may be admitted but will be required to complete certain courses which do not give graduate credit.

When a student is admitted to candidacy for the Master of Science Degree in Zoology, the Chairman of the Department (with the advice of the staff member in charge of the thesis) shall determine, in light of the students objectives, courses and other requirements to be completed by the candidate. Candidates for the Master's Degree in Zoology will be required to pass an oral examination covering (1) their general preparation in the field; (2) their

graduate and undergraduate courses in the biological sciences; and (3) the thesis.

The number of thesis credits which can be earned will be six.

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. Bullock. Prereq.: Biol. 2 and one year of Zoology. 2 lec.; 2 lab.; 4 cr.

56. Invertebrate Zoology. A survey of the major invertebrate groups, exclusive of insects, with emphasis on free-living forms. Evolution of various phyla and their ecological relationships. Mr. Moore. Prereq.: Zool. 7. 2 lec.; 2 lab.; 4 cr. (Given in alternate years; offered in 1949-50.) (Formerly Zool. 55.)

57. Laboratory Technique. Methods in histologic technique and examination of blood, urinary sediments, parasites, and zoological preparations. Prereq.: Zool. 53 or Zool. 66 and permission of the instructor. 1 lec.; 3 lab.; 4 cr. (May be taken concurrently with Zool. 66.)

59. General Physiology. The chemical and physical nature of the living substance. The processes of metabolism, movement of materials, irritability, response, lectures, assigned topics, and laboratory experiments. Mr. Milne. Prereq.: Biol. 2, one year of Zoology, a year of college Physics and a course in Organic Chemistry; 3 lec.; or rec.; 1 lab.; 4 cr.

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

65. Embryology. A study of the fundamental principles of development. The developmental process from the egg to the formation of the body and the establishment of the principal organs and systems. Miss Allen. Prereq.: Zool. 8, 2 lec.; 2 lab.; 4 cr. (Formerly Zool. 54.)

66. (I) Histology. This course gives the student a familiarity with the microscopical anatomy of the principal tissues and organs of vertebrates. Mr. Bullock. Prereq.: Zool. 8 or 18. 2 lec.; 2 lab.; 4 cr. (Formerly Zool. 53.)

71, 72. Ecology of the Vertebrates. A study of the habitat and ecological relationships of the vertebrates with special reference to their conservation. Field methods and techniques will be stressed. Mr. Jackson. Prereq.: 12 hours of Biology. 2 lec.; 1 lab.; 3 cr. (Given in alternate years; not offered in 1949-50.)

73. Ichthyology. A study of fishes; their identification, habits, habitats, economic importance, life histories with special reference to those forms occurring in eastern North America. Designed for students interested in wildlife conservation and those preparing to become aquatic biologists. Mr. Jackson. Prereq.: Biol. 1-2, and 8 hours of Zoology. 2 lec.; 1 lab.; 3 cr. (Given in alternate years; offered in 1949-50.)

74. Herpetology. A study of reptiles and amphibia; their identification, habits, habitats, economic importance, life histories with special reference to those forms occurring in eastern North America. Designed for students interested in wildlife conservation. Mr. Jackson. Prereq.: Biol. 2 and 8 hours of Zoology. 2 lec.; 1 lab.; 3 cr. (Given in alternate years; offered in 1949-50.)

81. Laboratory Methods. Preparation of biological material for the classroom; instruction in making models, aquaria, and collecting and preparing specimens for class demonstration; histology, technique, and hematology. Prereq.: 12 hours of Biology and permission of the instructor. 1 lec.; 2 lab.; 3 cr. (Offered only in summer.)

87, 88. Zoology Seminar. Seminar discussions on current Zoological literature conducted each week. Primarily for Seniors majoring in Zoology and for Graduate Students. Mr. Moore and staff. Prereq.: Permission of the Department Chairman. 1 hour per week. 1 cr.

96. Limnology. Factors affecting biological productivity of freshwater lakes and streams. Adopted primarily for students interested in fish and game management, wildlife conservation, and in teaching Biology. Mr. Moore. Prereq.: Permission of the instructor. (Given in alternate years; not offered in 1949-50.)

97, 98. Special Problems. 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. Mr. Moore 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 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 animals population. Mr. Jackson. Prereq.: 3 years' work in Biology. 2 lec.; 2 lab.; 4 cr.

111, 112. Problems in Biology. This course involves reading, laboratory work, and conferences on special problems approved by the staff. Mr. Moore and staff. Prereq.: Permission of the Department Chairman. 1-4 cr.

151. Parasitology. An introductory course concerned with some of the more important parasites causing diseases of man and animals. This course will meet with Zoology 51. Students will be expected to do extra reading and laboratory work. Not open to students who have credit for Zoology 51. Mr. Bullock. Prereq.: 14 hours of Zoology. 2 lec.; 2 lab.; 4 cr.

152. Advanced Parasitology. A study of helminth and protozoan parasites. Life cycles, physiology of parasites, examination of hosts, parasitological techniques. Mr. Bullock. Prereq.: Zool. 51 or 151. 2 conf.; 2 lab.; 4 cr.

156. Invertebrate Zoology. A survey of the major invertebrate groups, exclusive of insects, with emphasis on free-living forms. Evolution of various phyla and their ecological relationships. This course will meet with Zoology 56. Students will be expected to do extra reading as well as extra work in the identification of local fauna. The proximity of Durham to salt water gives an excellent opportunity for the study of marine invertebrates in their habitats. Not open to students who have credit for Zoology 56 or 55. Mr. Moore. Prereq.: 16 hours of Zoology including Zool. 7. 2 lec.; 3 lab.; 5 cr.

159. General Physiology. The chemical and physical nature of the living substance. The processes of metabolism, movement of materials, irritability, response. This course will meet with Zoology 59. Students will be expected to do extra reading and laboratory work. Not open to students who have credits for Zoology 59. Mr. Milne. Prereq.: 16 hours of Zoology, a year of college physics and a course in Organic Chemistry. 3 lec.; 1 lab.; 4 cr.

160. Experimental Physiology. Laboratory study of aspects of metabolism, movement of materials, irritability and response, with careful consideration of methods, accuracy, interpretation and presentation of results. A biophysical and biochemical approach of living systems. Mr. Milne. Prereq.: Zool. 59 or 159. 2 lec.; 2 lab.; 4 cr.

165. 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. This course will meet with Zoology 65. Students will be expected to do extra reading and laboratory work. Not open to students with credit for Zoology 65 or 54. Miss Allen. Prereq.: 12 hours of Zoology. 2 lec.; 2 lab.; 4 cr.

166. Histology. This course gives the student a familiarity with the microscopical anatomy of the principal tissues and organs of vertebrates. This course will meet with Zoology 66. Students will be expected to do extra reading and laboratory work. Not open to students who have credit for Zoology 66 or 53. Mr. Bullock. Prereq.: 14 hours of Zoology. 2 lec.; 2 lab.; 4 cr.

168. Physiology of Development (*formerly 107, 108*). Problems related to fertilization, histogenesis, and organogenesis will be discussed with an emphasis on the experimental approach in both invertebrate and vertebrate groups. Miss Allen. 2 hours seminar. 1 lab.; 3 cr. Prereq.: Zool. 65 or 165.







