

## Descriptions – Fisheries and Wildlife

### of Courses

#### 871. Ecology of Fishes

Summer of even-numbered years. 3 credits. Approval of department. Given at the W. K. Kellogg Biological Station. Interdepartmental with and administered by the Department of Zoology.

Exploration of ecological problems with particular emphasis on growth, food and habitat selection, population biology and niche relations. Field and experimental investigations of fish communities.

#### 872. Fish Communities and Aquatic Ecosystems

Winter of even-numbered years. 3(3-0) Approval of department.

Processes by which fish influence the structure and function of aquatic ecosystems.

#### 873. Ecology and Management of Stream Fish

Winter of odd-numbered years. 3(4-0) F W 376, ZOL 389 or BOT 450; or F W 476 or concurrently.

Flowing water habitat as it affects fish, with influences of climate, vegetation, land use, water withdrawal; damming, channel alteration and fishery management.

#### 874. Advanced Biological Limnology

Fall of odd-numbered years. 3(4-0) F W 477, or approval of department.

Historical and current contributions to concepts of community structure, energy flow and materials cycling in aquatic eco-systems.

#### 875. Chemical Limnology

Winter. 4(3-3) F W 476, F W 477 or approval of department.

Application of analytical chemistry concepts and technologies to fundamental chemical mechanisms in natural and polluted water systems. Special consideration given to selected heterogeneous equilibria.

#### 876. Applied Limnology

Spring. 3(3-0) F W 874 or F W 875 or approval of department.

Aquatic ecology: quantitative relationship between physical, chemical and biological parameters in polluted and unpolluted lakes and streams.

#### 877. Fish Population Dynamics

Winter of odd-numbered years. 3(3-0) Approval of department.

Quantitative analysis of fish populations; rates of change and their underlying causes.

#### 897. Ecosystem Ecology

Fall. 3(3-0) ZOL 389 or BOT 450. Interdepartmental with and administered by the Department of Zoology.

Concepts of ecosystem structure, energy flow, and nutrient cycling in representative terrestrial and aquatic ecosystems.

#### 899. Master's Thesis Research

Fall, Winter, Spring, Summer. Variable credit. Approval of department.

#### 940. Quantitative Wildlife Ecology

Fall of even-numbered years. 3(3-0) Approval of department.

Fundamentals of population demographics. Rates of increase, dynamic and static life tables, logistic theory, the Leslie matrix model, age specific and time specific parameters. Current hypotheses on mechanisms promoting population stability.

#### 999. Doctoral Dissertation Research

Fall, Winter, Spring, Summer. Variable credit. Approval of department.

## FOOD SCIENCE AND HUMAN NUTRITION

### College of Agriculture and Natural Resources College of Human Ecology

#### Food Science

FSC

#### 101. Food and Society (N)

Fall, Winter. 3(3-0) Interdepartmental with Human Nutrition and Foods.

Analysis of the scientific, social and environmental aspects of food in determining the quality of human life. Introduction into the principles of food preservation and safety.

#### 205. Food Laws and Regulations

Spring. 3(3-0) Interdepartmental with Human Nutrition and Foods.

Food laws and regulations that govern food processing and food service systems; procedures involved in adopting and enforcing food laws and regulations.

#### 211. Introduction to Food Science

Spring. 3(3-0)

Modern food processing, world food problems, and the basic characteristics of processed foods.

#### 256. Meats, Poultry and Fishery Products I

(242.) Fall. 3(2-2) Interdepartmental with the Department of Animal Science.

Principles of evaluation and nutritive value. Identification of grades and cuts of beef, pork, lamb and poultry products.

#### 300. Dairy Products

Spring. 3(2-2) CEM 132 or approval of department.

Chemical and physical properties of milk and milk products. Survey of dairy products and the technologies involved in their manufacture.

#### 310. Food Safety and Microbiology

Fall. 4(3-3) Juniors; CEM 132 or concurrently or approval of department. Not open to students with credit in FSC 440. Interdepartmental with the Department of Microbiology and Public Health.

Effects of food handling, preparation and service on food safety. Microorganisms in foods, sanitation, food borne disease and food service regulations.

#### 311. Food Processing and Preservation

Winter. 3(3-0) CEM 132. Not open to majors in Food Science.

Effects of processing, packaging and preservation on the quality of foods. Demonstrations of use of ingredients, evaluation of products and results of various processing methods.

#### 329. Unit Operation and Food Processing I

Fall. 4(3-2) PHY 237, MTH 109. Interdepartmental with and administered by Agricultural Engineering Technology.

Engineering concepts related to the unit operations found in the food industry. Fluid mechanics, heat transfer and rate processes including psychrometrics and refrigeration.

#### 331. Physical Principles of Food Processing

Fall, Winter. 4(3-2) FSC 211, MTH 109; PHY 239 or approval of department.

Food preservation by heat, low temperature, dehydration and radiation.

#### 332. Biological Principles of Food Processing

Winter. 4(3-3) MPH 200 or approval of department.

Biological problems related to food processing including waste disposal, sanitizing and bactericidal compounds, pesticides and residues, plant and animal growth regulators, radioactive elements, preservatives and toxicology of additives.

#### 333. Chemical Principles of Food Processing

Spring. 4(3-3) FSC 211 and CEM 241 or approval of department.

Chemical changes in foods that affect the texture, color, flavor, odor, stability, and nutritive quality during processing and storage.

#### 400. Milk Processing Technology

Fall. 4(3-3) CEM 132 or approval of department.

The fluid milk industry. Composition, quality, sanitation, nutritive value, processing, packaging and distribution of milk and milk products.

#### 401. Industrial Food Fermentations

Fall. 3(3-0) FSC 440 and organic chemistry or approval of department.

Physical, microbiological and chemical procedures in utilizing microbial cultures in controlled fermentations of foods and food constituents.

#### 402. Chemistry and Technology of Lipids

Winter. 3(3-0) One term organic chemistry.

Chemical and physical properties of edible fats and oils. Refining and processing of lipids into margarine, butter, shortening and salad oils. Chemical methods for analysis of lipids.

#### 404. Dehydrated Foods

Spring. 3(3-0) FSC 331; FSC 333 concurrently or approval of department.

Concentration and dehydration of foods by roller, spray, and freeze drying and foam, puff and tunnel drying. Stability and nutritional aspects of dehydrated foods.

#### 405. Technology of Manufactured Dairy Products

Winter. 4(3-3) FSC 400 or approval of department.

Manufacturing technology of fermented dairy foods, frozen dairy desserts, and imitation dairy products.

#### 421. Food Plant Management

Spring. 3(3-0) Seniors or approval of department.

Business and technical management concepts associated with food plants. Efficiency factors, regulatory obligations, and administrative aspects.

#### 440. Food Microbiology

Spring. 5(3-4) MPH 200 or MPH 301 or approval of department. Interdepartmental with the Department of Microbiology and Public Health.

Major groups of microorganisms of importance to the food industry are studied with emphasis on ecological, physiological, and public health aspects.

- 445. Meat, Poultry and Fishery Products III**  
Spring. 3(1-6) FSC 333 or approval of department.  
Processing, formulation and quality control.
- 448. Fruit, Vegetable and Cereal Products I**  
Fall. 4(3-3) FSC 331 or approval of department.  
Quality factors involved in canning, sugar and salt preservation and milling.
- 449. Fruit, Vegetable and Cereal Products II**  
Winter. 4(3-3) FSC 331 or approval of department.  
Quality factors involved in cooling, freezing and other preservation procedures.
- 455. Food Analysis I**  
Fall, Spring. 4(2-4) CEM 132 and CEM 162 or approval of department.  
Modern methods of analysis for fat, protein, moisture and other macroconstituents of food. Application of spectrophotometry in determination of microconstituents; use of dye-binding, complexometric and iodimetric techniques in food analysis.
- 456. Food Analysis II**  
Winter. 4(2-6) CEM 162 and CEM 241 or approval of department.  
Use of colorimetry and spectrophotometry, chromatographic methods and other techniques for the analysis of food constituents and additives.
- 457. Quality Control in the Food Industry**  
Winter of even-numbered years. 3(3-0) STT 201 or approval of department.  
Organization of and tools used for quality control: control charts, acceptance and auditing inspections, critical control points, reliability, safety, recall and liability.
- 480. Special Problems in Food Science**  
Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 9 credits.  
Advanced undergraduates may select research work in food chemistry, food microbiology, food engineering, food plant management, processing dairy products, meat, poultry and fishery products, fruits and vegetables, cereals or beverages.
- 490. Seminar**  
Fall. 1(1-0) Approval of department.  
Preparation and presentation of reports on a specialized aspect of food science.
- 830. Thermal Processing of Food Products**  
Winter. 4(3-3) FSC 331, FSC 332 or FSC 440 or approval of department.  
Heating and cooling characteristics of foods in containers, thermal resistance of microorganisms, and derivation of process times and temperatures for pasteurization and sterilization.
- 831. Rheology and Texture of Food**  
Fall. 3(2-2) Approval of department.  
Definition, measurement, analysis of and relationship between the rheological and textural parameters which describe food. Relationship between basic rheology and food texture.
- 832. Microbiology of Food Processing**  
Winter. 3(2-3) FSC 440 or approval of department.  
Control of food spoilage and food poisoning microorganisms in food processing and the role of bacterial spores in process selection.
- 834. Flavor Quality Control**  
Spring of odd-numbered years. 4(3-3) Approval of department.  
Sensory methods used for food evaluation and panel analyses. Flavor chemistry and analytical methods. Sampling plans, control charts, and acceptance sampling for statistical quality control.
- 835. Carbohydrates in Foods**  
Fall of odd-numbered years. 3(3-0) FSC 333.  
The chemistry and food technology of mono-, oligo-, and poly-saccharides.
- 850. Selected Topics in Food Science**  
Fall, Winter, Spring, Summer. 2 to 4 credits. May reenroll for a maximum of 12 credits. Approval of department.  
Advanced studies; food utilization, texture, additives, toxicants, food proteins, ingredient safety, nutrient stability, new processing techniques, flavors, quality control, storage stability, state and federal food regulations.
- 880. Special Problems in Food Science**  
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 12 credits. Approval of department.  
Investigation of food science areas of special interest to individual graduate students.
- 899. Master's Thesis Research**  
Fall, Winter, Spring, Summer. Variable credit. Approval of department.
- 932. Histological and Chemical Techniques**  
Winter. 3(1-6) Approval of department.  
Research techniques in thin-layer and gas chromatography, differential thermal analysis, isoelectric focusing, histology, histochemistry, biological testing, polarography and pH stat measurements.
- 933. Instrumental Methods of Analysis**  
Spring. 3(2-3) FSC 455 or FSC 456 or approval of department.  
Spectroscopy (ultraviolet, visible, infrared, flame, atomic absorption, fluorescence), manometry, ion exchange, counter-current distribution, radioisotopic tracers.
- 934. Research Techniques with Proteins**  
Fall. 3(2-3) BCH 401 or BCH 451.  
Physical and chemical techniques applicable to protein characterization (including—electrophoretic techniques, thin-layer chromatography, gel filtration, ultracentrifugation and amino acid analysis).
- 951. Muscle Biochemistry**  
Spring. 3(3-0) BCH 451 or approval of department.  
The structure and function of living muscle. Emphasis is placed upon the chemical and energy changes of muscle in contraction. Changes occurring after death during rigor development are also discussed.
- 952. Advanced Lipids**  
Winter of even-numbered years. 3(3-0) FSC 402 or approval of department.  
A course relating composition, structure, and physical and chemical properties of lipids to processing requirements of fats and oils to their function in food systems.
- 953. Food Enzymology**  
Spring of even-numbered years. 3(3-0) FSC 333, BCH 401 or approval of department.  
Production, utilization and application of food enzymes in food industries. Effects of food enzymes on quality and nutrients of foods and food products.
- 953L. Laboratory-Food Enzymology**  
Spring of even-numbered years. 2(0-4) FSC 953 or concurrently or approval of department.  
Research methods in the isolation, purification, and characterization of food enzymes and the use of food enzymes in food industries.
- 990. Food Science Seminar**  
Fall, Winter, Spring. 1(1-0) May reenroll for a maximum of 3 credits toward M.S. and 6 credits toward the Ph.D. Approval of department.  
Preparation and presentation of reports on a specialized aspect of research findings in food science.
- 999. Doctoral Dissertation Research**  
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

**Human Nutrition and Foods**

HNF

- 100. Elementary Food Preparation**  
Fall, Winter, Spring. 4(2-4)  
Composition and properties of food related to quality characteristics; methods of preparation, evaluation of quality and use of selected foods.
- 101. Food and Society (N)**  
Fall, Winter. 3(3-0) Interdepartmental with and administered by Food Science.  
Analysis of the scientific, social and environmental aspects of food in determining the quality of human life. Introduction into the principles of food preservation and safety.
- 102. Nutrition for Humans (N)**  
Fall, Winter, Spring, Summer. 3(3-0)  
Fundamentals of nutrition with reference to diverse ways people provide for and attach meaning to food.
- 200. Physical and Chemical Properties of Foods**  
Fall, Winter. 4(2-4) CEM 131 or concurrently, or CEM 141.  
Interrelationships between basic physical and chemical principles and food preparation: composition, methods of preparation, evaluation, quality standards and comparative analysis.
- 205. Food Laws and Regulations**  
Spring. 3(3-0) Interdepartmental with and administered by Food Science.  
Food laws and regulations that govern food processing and food service systems; procedures involved in adopting and enforcing food laws and regulations.

**Descriptions - Food Science and Human Nutrition  
of  
Courses**

**221. Food and the Consumer**  
Fall, Winter, Spring. 3(3-0) Sophomores or approval of department.  
Factors affecting the food supply, consumer protection, food buying and management of human and material resources in feeding the family.

**222. Food and the Consumer Laboratory**  
Fall, Winter, Spring. 2(0-4) HNF 221 or concurrently.  
Decision making in Foods and Nutrition with emphasis on food choices in the marketplace. Management of human and nonhuman resources in food consumerism activities.

**290. Professional Literature I**  
Fall, Spring. 2(2-0) HNF 102 or HNF 100 or HNF 200 or FSC 101, Sophomores; departmental majors.  
Identification of factors and development of analytical skills involved in evaluating and communicating scientific information.

**300. Experimental Foods**  
Winter, Spring. 4(2-6) HNF 200, CEM 132; FSC 310 or concurrently.  
Experimental approach to the study of foods, relating chemical and physical properties to reactions and processes occurring in food in response to various treatments.

**310. Sensory Assessment of Foods**  
Winter. 2(1-2) HNF 290, HNF 300 or concurrently.  
Sensory perception, chemistry of food flavors, and methods used in organoleptic evaluation of foods.

**312. Nutrient Composition of Foods**  
Winter. 1(0-2) HNF 102 or FSC 101.  
Sources of nutrient composition information and their use in menu planning. Choosing foods to meet nutrient needs of various groups.

**315. Consumer Aspects of Food Consumption**  
Fall. 3(3-0) HNF 102 or FSC 101; EC 200.  
Economic issues of concern to consumers in the food marketplace; human resource allocation to consumer food consumption activities; federal food programs affecting consumers' nutritional status.

**319. Food Service Systems: General Survey**  
Fall, Winter, Spring. 3(3-0) HNF 222 or concurrently; or approval of department.  
Factors which influence the design of food service systems. Comparison of systems as related to organizational objectives and responsibilities, operational resources (material, human) and consumer acceptance factors.

**321. Food Service Management: Material Resources**  
Fall, Winter, Spring. 3(2-2) HNF 319 or approval of department.  
Principles, processes and operational control strategies in materials management in food service systems. Menu planning, procurement, on-premise storage and issue, production, consumer distribution, safety, sanitation, and material cost analysis.

**330. Nutrition in the Life Cycle: Children**  
Winter. 3(3-0) HNF 102; FCS 262A, three terms of natural science or approval of department.  
Functions and importance of nutrients to physical growth, development and health of the child. Eating behavior of children. Feeding in child care centers.

**375. Community Nutrition**  
(475.) Fall. 3(3-0) HNF 102 or approval of department.  
Identification of nutritional needs of population groups and available resources in communities.

**379. Dietetics: Theory-Practice Interrelationships I**  
(478.) Winter. 3(2-3) HNF 102, CEP 450 or concurrently or approval of department.  
Introduction and practice of competencies required of the professional dietitian. Skills in communication, interviewing, problem solving and planning for nutritional care will be developed using simulated and real life situations.

**400H. Honors Work**  
Fall, Winter, Spring, Summer. Variable credit. May reenroll for a maximum of 16 credits. Seniors, approval of department.

**403. Fats and Carbohydrates in Food Systems**  
Fall. 4(3-3) HNF 300 or approval of department.  
Chemical and physical reactions in fat and carbohydrate food systems, including sols, gels, emulsions, etc. Food evaluation techniques will be introduced.

**404. Role of Proteins in Food Systems**  
Winter. 4(3-3) HNF 300 or approval of department.  
Physical and chemical reactions with protein foods, meats, eggs, cheese, seeds. Emphasis on time-temperature data in relation to quality.

**406. Cultural Aspects of Food**  
Spring, Summer of odd-numbered years. 3(3-0) Juniors.  
A cross cultural investigation of food and its consumption. Factors such as history, religion, food sources and socio-economic status are considered.

**406L. Laboratory-Cultural Aspects of Food**  
Spring. 1(0-3) HNF 100 or HNF 200 or approval of department; HNF 406 concurrently.

Art and science of cookery in relation to historical, national, regional, racial and religious customs.

**407. Interactions of Culture and Nutrition**  
Spring. 3(3-0) Juniors; HNF 102 or ANP 171 or approval of instructor. Interdepartmental with the Department of Anthropology.  
World and U.S. food behavior focusing on conflicts between behavior and nutritional needs at various stages of life cycle. Anthropological, psychological and social influences affecting food behavior are analyzed.

**411. Principles of Human Nutrition**  
Winter, Summer. 4(3-2) BCH 200.  
Identification, function and food sources of nutrients required by man. Metabolism as affected by deficiency or excess of specific nutrients.

**420. Food Service Management: Human Resources**  
Fall, Winter, Summer of odd-numbered years. 3(2-2) HNF 321 and PSY 356 or approval of department.  
Principles, processes and operational control strategies in personnel management in food service systems. Hiring, training, and dismissal procedures; labor-management relations; task analysis and distribution; productivity assessment; and labor cost analysis.

**421. Food Service Management: Problem Analysis and Decision Making**  
Winter, Spring, Summer of even-numbered years. 3(1-4) HNF 420 or approval of department.  
Analysis of selected food service problem situations. Application of problem-solving techniques, identification of cause and effect factors, analysis of situational components and development of remedial alternatives for administrative action.

**461. Energy Nutrients and Proteins for Human Nutrition**  
Fall. 4(4-0) BCH 200; PSL 432 or PSL 241.  
Metabolism of protein, fats and carbohydrates as applied to the nutritional requirements and food supplies of people.

**462. Vitamins and Minerals for Human Nutrition**  
Winter. 3(3-0) HNF 461.  
Metabolism of vitamins and minerals as applied to the nutritional requirements and food supplies of people.

**463. Nutrition and Human Development**  
Winter. 4(3-2) HNF 462 or approval of department.  
The role of nutrients in physiological systems and biochemical processes as related to the perspective of human growth and development.

**470. Clinical Nutrition**  
Spring. 3(3-0) HNF 462; PHM 350 or approval of department.  
Changes in physiological and/or biochemical functions or processes due to illness and uses of modified diets as an essential part of treatment.

**470P. Clinical Nutrition Practicum**  
Spring. 1(0-2) 470 concurrently.  
Assessment of nutritional status. Modification of the hospital general menu for implementation of diets prescribed for treatment of disease.

**473. Interpretation of Clinical Laboratory Tests in Dietetics**  
Spring. 4(3-2) HNF 470 or concurrently.  
Principles, procedures and interpretation of clinical laboratory methods with particular emphasis on their interpretation relative to nutritional status and therapeutic nutrition.

**475P. Community Nutrition Fieldwork**  
Fall, Winter, Spring, Summer. 1(0-3) Seniors; HNF 375 or concurrently.  
Application of community nutrition principles in field settings. Instructor arranged projects in nutrition survey techniques or delivery of nutrition education services.

**479. Dietetics: Theory-Practice Interrelationships II**  
Spring. 3(2-3) HNF 379, HNF 420 or approval of department.

Continuation of HNF 379. Development of skills in nutritional and employee counseling, resource management and professional behavior using simulated and real life situations.

**480. Practice of Dietetics**  
Fall, Winter, Spring, Summer. 12(2-30) May reenroll for a maximum of 24 credits. HNF 303, HNF 470.

Application and integration of nutritional and managerial concepts related to the practice of dietetics.  
Approved through Spring 1983.

**490A. Professional Literature II: Foods**  
Fall. 2(2-0) HNF 290, HNF 300 or HNF 403 or approval of department.

Selected topics in foods research. Emphasis on experimental data and basic scientific principles related to food quality, nutritive stability and food safety.

**490B. Professional Literature II: Nutrition**

Spring. Summer of even-numbered years. 2(2-0) HNF 290, HNF 462 or approval of department.

Emphasis on experimental data and scientific principles related to basic nutrition research. Focus on current developments in nutrient requirements, metabolism and interactions

**490C. Professional Literature II: Clinical Nutrition**

Spring. 2(2-0) HNF 290, HNF 470 or concurrently or approval of department.

Selected topics in clinical nutrition research. Emphasis on human investigative data and scientific principles related to nutritional care of patients/clients including pathophysiologic correlations, nutritional assessment, diet planning, nutrition counseling.

**490D. Professional Literature II: Food Service Management**

Spring, Summer. 2(2-0) HNF 290, HNF 420 or concurrently or approval of department.

Examination of trends, problems and research in food service systems operation. Focus on current issues and developments relating to materials handling, manpower needs, operational accountability and public responsibility.

**490E. Professional Literature II: Foods and Nutrition Information**

Spring. Summer of odd-numbered years. 2(2-0) HNF 290, HNF 411 or HNF 462 or approval of department.

Selected topics in foods and nutrition information. Emphasis on research related to method and effectiveness of nutrition education.

**495. Independent Study**

Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 9 credits. Seniors; approval of department.

Individual study of selected topics in foods, nutrition and food service management under staff guidance.

**498. Field Study**

Fall, Winter, Spring, Summer. 3 to 12 credits. May reenroll for a maximum of 12 credits. Approval of department.

Planned program of research, observation, study or work in selected organizations under staff guidance.

**800. Seminar in Foods and Nutrition**  
Fall, Winter, Spring. 1(1-0) HNF 403 or HNF 463.

**802. Seminar in Food Service Management**

Spring. 2 to 4 credits. May reenroll for a maximum of 4 credits. Approval of department.

**803. Problems in Food Service Management**

Fall, Winter, Spring, Summer. Variable credit. Approval of department.

**805. Experimental Foods III**

Spring. 4(1-9) HNF 404 or approval of department.

Planning, executing, and reporting individual research project. Data collection, evaluation and interpretation to demonstrate understanding of research techniques and attitudes, and an awareness of significant problems in the field.

**813A. Special Studies in Nutrition**

Fall, Winter, Spring, Summer. Variable credit. HNF 461.

**813B. Special Studies in Experimental Foods**

Fall, Winter, Spring, Summer of odd-numbered years. Variable credit. HNF 404; BCH 200 or BCH 451 and BCH 804.

**813C. Special Studies in Food Service Management**

Fall, Winter, Spring, Summer. Variable credit. Approval of department.

Special studies in facility management, manpower coordination and tools and methods of operational control.

**816. Applied Human Nutrition**

Spring. 3(3-0) HNF 462.

**840. Topics in Nutrition**

Fall, Winter, Spring, Summer. 2 to 3 credits. HNF 462, PSL 432, BCH 401.

Advanced studies in nutrition: assessment and surveillance, community, clinical, growth and development, behavior, infectious disease and environment, oral health, obesity, aging, diet.

**841. Nutrition and Obesity**

Winter of even-numbered years. 2(2-0) One undergraduate course in nutrition, biochemistry or physiology.

Assessment, energy metabolism, and risk factors associated with obesity. Significance of nutrition and other factors for weight control and reduction.

**899. Master's Thesis Research**

Fall, Winter, Spring, Summer. Variable credit. Approval of department.

**921. Pathology of Nutritional and Metabolic Diseases**

Spring of odd-numbered years. 4(3-2) Approval of department; PTH 404 or ANT 420. ANS 525, BCH 452, HNF 462 recommended. Interdepartmental with and administered by the Department of Large Animal Clinical Sciences.

Development, physiopathology and morphologic pathology of nutritional and metabolic diseases including carbohydrate, protein, fatty acid, vitamin and mineral deficiencies, their experimental induction and their medical or economic significance.

**926. Comparative Nutrition-Lipids and Carbohydrates**

Winter of odd-numbered years. 4(4-0) BCH 452 and a previous course on principles of nutrition. Interdepartmental with Animal Husbandry.

Regulatory aspects of carbohydrate and lipid metabolism as influenced by nutrition in mammals. Emphasis on normal and abnormal physiological states such as obesity, ketosis and diabetes.

**927. Comparative Nutrition-Protein Metabolism and Developmental Biology**

Winter of even-numbered years. 4(4-0) BCH 452, PSL 802 or concurrently. Interdepartmental with Animal Husbandry.

Protein quality assessment, protein status, protein caloric malnutrition, amino acid metabolism, protein turnover, digestion and absorption, hormonal control of protein metabolism, developmental aspects of protein metabolism and growth.

**928. Comparative Nutrition-Minerals**

Spring of even-numbered years. 3 credits. BCH 452, PSL 802. Interdepartmental with and administered by Animal Husbandry.

Forms and location in body, metabolic roles, deficiency and toxicity signs, interrelationships, requirements and biological availability of sources.

**929. Comparative Nutrition-Vitamins**

Spring of odd-numbered years. 3(3-0) BCH 452 and a previous course on principles of nutrition. Interdepartmental with and administered by Animal Husbandry.

Chemical and physical properties, standards of activity, occurrence, metabolic roles, anti-vitamins, deficiency and toxicity signs, requirements and factors affecting requirements.

**999. Doctoral Dissertation Research**

Fall, Winter, Spring, Summer. Variable credit. Approval of department.

## **FOOD SYSTEMS ECONOMICS AND MANAGEMENT**

See Agricultural Economics.

## **FOREIGN LANGUAGES**

See Linguistics and Germanic, Slavic, Asian and African Languages, and Romance and Classical Languages.

## **FORESTRY FOR**

### **College of Agriculture and Natural Resources**

In 305, 306, 402 and 430, field trips are scheduled for several consecutive days away from the campus for integrated field experience, primarily in the second half of spring term of the junior year, so that these courses must be taken concurrently. This precludes enrollment in other courses during that term. The approximate cost of these field trips is \$200.