873. Ecology and Management of Stream Fish
   Winter. 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 materi­
   als cycling in aquatic eco-systems.

875. Chemical Limnology
   Winter. 4(3-3) F W 476, F W 477 or ap­
   proval of department.
   Application of analytical chemistry concepts and
   technologies to fundamental chemical mecha­
   nisms in natural and polluted water systems. Special
   consideration given to selected hetero­
   geneous equilibria.

876. Applied Limnology
   Spring. 3(3-0) F W 874 or F W 875 or ap­
   proval of department.
   Aquatic ecology; quantitative relationship be­
   tween physical, chemical and biological param­
   eters in polluted and unpolluted lakes and
   streams.

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

4.0. Quantitative Wildlife Ecology
   Fall. 3(3-0) Approval of department.
   Fundamentals of population demographics. Rates
   of increase, dynamic and static life tables, logis­
   tic theory, the Leslie matrix model, age-spe­
   cific and time specific parameters. Current hy­
   potheses on mechanisms promoting population
   stability.

999. 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

101. Food and Society
   Fall, Winter. 3(3-0) Interdepartmental with
   Human Nutrition and Foods.
   Analysis of the scientific, social and environmen­
   tal aspects of food in determining the quality of
   man’s life. Introduction into the principles of
   food preservation and safety.

211. Introduction to Food Science
   Spring. 3(3-0)
   Modem food processing, world food problems,
   and the basic characteristics of processed foods.

215. World Food Issues
   Spring. 3(3-0) Interdepartmental with
   and administered by the Department of Geog­
   raphy.
   Food resources as related to world distributions
   of population, soil, water, fuel and minerals. Special
   attention to urbanization, irrigation, and future
   food needs and global constraints.

223. Commercial Food Processing
   Systems
   Fall. 3(3-0) Interdepartmental with
   and administered by Physical Systems in Ag­
   riculture and Natural Resources.
   Processes and systems used in handling, pro­
   cessing and distribution of food; the need for
   processing systems and their influence on food
   quality.

342. Meats, Poultry and Fishery
   Products I
   Fall. 3(2-3) Interdepartmental with the
   Department of Animal Husbandry.
   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.

311. Food Processing and
   Preservation
   Winter, Summer. 4(4-0) CEM 132 or
   HR 1245 or approval of department; not open to
   majors in Food Science.
   Effects of processing, packaging and preserva­
   tion on the quality of foods. Demonstrations of
   use of ingredients, evaluation of products and
   results of various processing methods.

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, de­
   hydration 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 bac­
   teriocidal compounds, pesticides and resistors,
   plant and animal growth regulators, radioactive
   elements, preservatives and toxicology of addi­
   tives.

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, packag­
   ing 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 pro­
   cedures in utilizing microbial cultures in con­
   trolled fermentations of foods and food con­
   stituents.

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(3-2) FSC 331; FSC 333 con­
   currently or approval of department.
   Concentration and dehydration of foods by
   roller, spray, and freeze drying and foam, puff
   and tunnel drying. Stability and nutritional as­
   pects 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 as­
   pects.

440. Food Microbiology
   Fall. Dietetics majors only. Spring.
   5(3-4) MPH 200 or approval of de­
   partment. Interdepartmental with the De­
   partment 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 as­
   pects.

445. Meat, Poultry and Fishery
   Products II
   Fall. 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 milking.

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. 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 spectrography to determina­
   tion of microconstituents; use of dye-binding,
   colorimetric and titrimetric techniques in
   food analysis.
456. Food Analysis II
Winter. 4(3-6) CEM 352 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)
SIT 261 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.

460. Special Problems in Food Science
Fall, Winter, Spring. 1 to 3 credits. May reenroll for a maximum of 3 credits.
Investigation of food science areas of special interest to individual graduate students.

490. Seminar
Fall. 1-1(0) Approval of department.
Preparation and presentation of reports on a specialized aspect of food science.

828. Food Processing Concepts, Systems and Selected New Processes
Winter. 3(3-0) FSC 331, FSC 332, or FSC 440 or approval of department.
Concepts and requirements for processing systems and continuous processes. Use of computers in food processing, microwaving of foods, radiation preservation of foods and related processing methods.

899. Research
Fall, Winter, Spring. 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.

951. Muscle Chemistry
Spring. 3(3-0) FSC 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. Enzyme Reactions
Spring of odd-numbered years. 4(3-3)
BC 451 or approval of department.
Comprehensive discussion of parameters which affect enzyme activity. Properties of enzymes important in food processing.

954. Chemistry of Plant Products
Fall of even-numbered years. 3(3-9)
FSC 335, BCH 451, or approval of instructor.
Chemistry and biochemistry of plant pigments, tannins, toxins and proteins.

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

Human Nutrition and Foods

HNF 100. Elementary Food Preparation
Fall, Winter, Spring. 4(2-4)
Composition and properties of foods related to quality characteristics; methods of preparation, evaluation of quality and use of selected foods.

101. Food and Society
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 man's life. Introduction into the principles of food preservation and safety.

221. Food and the Consumer
Fall. 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.

300. Experimental Foods
Winter, Spring. 4(2-6) HNF 100; CEM 132; MPH 200 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.

301. Dynamics in Dietetics I
Fall. 2(0-4) Approval of department, HNF 461 concurrently.
Basic knowledge and experience in the functions and responsibilities of the professionally qualified dietitian. Local field trips required.

302. Dynamics in Dietetics II
Winter. 2(0-4) Approval of department, HNF 301, HNF 320 or concurrently and HNF 462 concurrently.
Principles and practices in the duties of professionally qualified dietitians with focus on providing food service for groups and nutritional care for patients and/or clients. Local field trips required.
303. **Dynamics in Dietetics III**  
Spring, 2(0-4) HNF 302; HNF 470 concurrently.  
Principles and practice of instructional design and instruction as applied to problems in dietetics.  
Local field trips required.

320. **Food Service Systems**  
Fall, Winter, Spring. 3(3-4) HNF 222.  
Juniors.  
Management of food service systems with varying organizational patterns and objectives.  
Emphasis on human and material resources and their interrelationships in quality food production and service.

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.  

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 oils, 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**  
Sprng. 1(0-3) HNF 100 or HNF 300 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**  
Fall. Summer of even-numbered years. 3(3-0) 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.

409. **Presentations in Foods and Nutrition**  
Winter. 4(2-4) HNF 300; HNF 411 or HNF 461.  
Principles and techniques of presenting foods and nutrition information as applied to teaching or promotional work.

411. **Principles of Human Nutrition**  
Winter, Summer. 4(3-2) BCH 300.  
Identification, function and food sources of nutrients required by man. Metabolism as affected by deficiency or excess of specific nutrients.

454. **Readings in Foods**  
Fall. Summer of even-numbered years. 3(3-0) HNF 300 or approval of department.  
Selected topics in foods research. Emphasis on experimental data and basic scientific principles related to food quality.

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. 3(3-0) HNF 461.  
The role of nutrients in physiological systems and biochemical processes as related to the perspective of human growth and development.

465. **Readings in Nutrition**  
(453.) Winter. Summer of odd-numbered years. 3(3-0) HNF 462 or approval of department.  
A study of recent developments in research in human nutrition.

470. **Clinical Nutrition**  
Spring. 4(4-0) HNF 462.  
Changes in physiological and biochemical functions or processes due to illness and uses of modified diets as an essential part of treatment.

473. **Clinical Chemistry 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.

475. **Community Nutrition**  
Spring. 3(3-0) HNF 402 or approval of department.  
Identification of nutritional needs of population groups and available resources in communities.

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

480. **Practice of Dietetics**  
Fall, Winter, Spring, Summer, 12(2-30)  
May reenroll for a maximum of 24 credits. HNF 300, HNF 470.  
Application and integration of nutritional and managerial concepts related to the practice of dietetics.

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.

499. **Field Study**  
Fall, Winter, Spring, Summer. 4 to 12 credits. May reenroll for a maximum of 12 credits.  
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.

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

502. **Seminar in Food Service Management**  
Spring. 2 to 4 credits. May reenroll for a maximum of 4 credits. Approval of department.

503. **Problems in Food Service Management**  
Fall, Winter, Spring. Variable credit. Approval of department.

505. **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.

513A. **Special Studies in Nutrition**  
Fall, Winter, Spring. Summer. Variable credit. HNF 461.

513B. **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.

513C. **Special Studies in Food Service Management**  
Fall, Winter, Spring. Variable credit. Approval of department.  
Special studies in facility management, manpower coordination and tools and methods of operational control.

516. **Applied Human Nutrition**  
Spring. 3(3-0) HNF 462.

540. **Topics in Nutrition**  
Fall, Winter, Spring, Summer. 2 to 3 credits. HNF 462, PSL 432, BCH 403.  
Advanced studies in nutrition: assessment and surveillance, community, clinical, growth and development, behavioral, infectious disease and environment, oral health, obesity, aging, diet.

599. **Research**  
Fall, Winter, Spring, Summer. Variable credit. Approval of department.
921. Pathology of Nutritional and Metabolic Diseases
Summer of even-numbered years. 4(3-2) Approval of department. FTH 404 or ANT 420. ANS 525, BCH 452, HNF 462 recommended. Interdepartmental with the department of Animal Husbandry and Pathology. Development, pathophysiology, 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 the Department of Animal Husbandry. Regulatory aspects of carbohydrate and lipid metabolism as influenced by nutrition in mammals. Emphasis on normal and abnormal physiologic states such as obesity, ketosis and diabetes.

927. Comparative Nutrition—Protein Metabolism and Development Biology
Winter of even-numbered years. 4(4-0) BCH 452, PSL 502 or concurrently. Interdepartmental with the Department of Animal Husbandry. Protein quality assessment, protein status, protein calorie 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 502. Interdepartmental with and administered by the Department of 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 the Department of Animal Husbandry. Chemical and physical properties, standards of activity, occurrence, metabolic roles, antitoxins, deficiency and toxicity signs, requirements and factors affecting requirements.

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

FOOD SYSTEMS ECONOMICS AND MANAGEMENT
See Agricultural Economics

FOREIGN LANGUAGES
See German and Russian, Linguistics and Oriental and African Languages, and Romance and Classical Languages.

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