

DESCRIPTION OF GRADUATE COURSES

- FDE 500 M.S. Thesis** NC
Program of research leading to M.S. degree, arranged between student and a faculty member. Students must start registering to this course no later than second semester of the program and do so in all semesters while the research program or write-up thesis is in progress.
- FDE 510 Total Quality Management for the Food Industry** (3-0)3
The philosophy and importance of Total Quality Management in food industry. Application of its tools and techniques: Quality Function Deployment, Benchmarking, Continuous Improvement, Deming Cycle, Statistical Process Control as well as Hazard Analysis and Critical Control Points to dairy, fermentation, meat and beverage industries. TQM applications in novel food processing techniques. Comparative study on real-life situations and problems in a typical food plant.
- FDE 511 Non-Thermal Processing Technology in Food Industry** (3-0)3
Principles of non-thermal processing foods. High hydrostatic (HHP), Pulsed Electric Field (PEF), Pulsed Light and Ozone applications. The theory of engineering systems and effects on microbiological, structural and biochemical systems of foods. Quality and shelf-life evaluations.
- FDE 515 Enzyme Engineering** (3-0)3
A biochemical engineering course on the production, purification and use of enzymes. The application of enzymatic processes in the food, pharmaceutical and chemical industries. The engineering principles involved in the analytical and industrial use of the immobilized enzymes.
- FDE 518 Advanced Process Calculations** (3-0)3
Critical review and discussion of the advanced modeling, optimization and control techniques appearing in the recent food and bioprocess engineering literature concerning kinetics of microbial death/growth and product formation; sterilization reactors, thermal processing, freezing preservation, drying, freeze drying, filtration, membrane separation, evaporation, crystallization, freeze concentration and distilled beverage production techniques.
- FDE 519 Transport Phenomena in Food Engineering** (3-0)3
Microscopic and macroscopic balances for momentum, energy and mass transport. Solutions of the equations for rheological systems with emphasis on food materials.
- FDE 561 Food Engineering Analysis** (3-0)3
Formulation of mathematical models describing food processing operations. Applications of numerical differentiation, integration; finite differences and regression analysis of food engineering problems.
- FDE 571 Advanced Food Biochemistry** (3-0)3
Advanced food chemistry with emphasis on proteins and enzymes. Protein interactions and their effect on the physical and chemical characteristics of foods. Preparation and kinetic properties of enzymes and their uses.
- FDE 572 Advanced Food Microbiology** (3-0)3
The interaction of microorganisms in foods and their role in food spoilage and bioprocessing. Bacterial sporulation, germination and physiological properties of bacterial spores and food safety.
- FDE 573 Advanced Biological Process Engineering** (3-0)3
Liquid-liquid extraction, solid-liquid extraction, chromatography, adsorption, ion exchange. Extrusion, expression. Membrane operations. Microwave heating. Radiation preservation.
- FDE 575 Food Analysis** (3-0)3
Advanced instrumental methods of food analysis including theory and applications.
- FDE 576 Industrial Microbiology** (3-0)3
Microbial processes involved in food and pharmaceutical processes, such as amino acids, nucleotides, vitamins, enzymes, antibiotics. Regulation of cellular activity. Molecular strain improvement technologies.
- FDE 578 Fabricated Foods Technology** (3-0)3
Novel sources of protein, fats and carbohydrates. Single cell proteins, hydrolyzed vegetable proteins, synthetic flavors. Separation, purification and texturizing new protein foods.
- FDE 579 Food Additives, Contaminants and Toxicology** (3-0)3

Intentional and non-intentional additives, natural toxic constituents of plant and animal foods. Mycotoxins, detoxification processes, package-food interactions. Food-drug interactions, residue analysis in foods.

FDE 580 Food Packaging (3-0)3
Requirements and functions of containers, types of containers, packaging materials; metal, glass, paper, plastics and films, laminates, edible films. Package testing, environmental issues.

FDE 581 Biochemical Engineering (3-0)3
Review of biological processes of engineering interest. Kinetics of enzyme catalyzed reactions. Kinetics of substrate utilization, biomass and product formation. Transport phenomena in microbial systems. Design and analysis of mixed culture systems. Isolation of biologically active materials.

FDE 582 Thermal Process Engineering (3-0)3
General principles of heat transfer. Conduction and thermal conductivity. Experimental methods for the determination of thermal conductivity, methods of analysis. Steady and unsteady state conduction. Analytical and numerical solutions. Thermal methods applied in food processing.

FDE 585 Engineering Properties of Foods (3-0)3
Critical review of various procedures for measurement and estimation of engineering properties of relevance to the design of food processing operations.

FDE 586 Supercritical Fluid Processing of Food (3-0)3
Supercritical fluid processing of food and biomaterials. Extraction, crystallization, extrusion processing, biochemical reactions, microbial inactivation.

FDE 587 Rheological Methods in Food Engineering (3-0)3
The theory of rheological testing and determination of rheological properties of foods from experimental

data. Stress and strain. Solid and fluid behaviours. Tube and rotational viscometry. Extensional flow. Transient and oscillatory testing for viscoelasticity.

FDE 589 Microwave Processing of Foods (3-0)3
Principles of microwave heating. Microwave processing: drying, baking, blanching, thawing, sterilization and cooking of foods. Modeling microwave heating characteristics. Development of microwavable foods.

FDE 591 Seminar I NC
M.S. students present their thesis proposal. Students must register to this course in the second semester of the program.

FDE 592 Seminar II NC
M.S. students present their thesis work. The seminar should include reasonable amount of results.

FDE 600 Ph.D. Thesis NC
Program of research leading to Ph.D. degree, arranged between student and a faculty member. Students must start registering to this course no later than the second semester of the program and do so in all semesters while the research program or write-up thesis is in progress.

FDE 7XX Special Topics in Food Engineering (3-0)3or (2-2)3
Courses not listed in catalogue. Contents vary from year to year according to interests of students and instructors in charge. Typical contents include Food Engineering, Food Processing, Food Science, Food Technology, Biotechnology etc.

FDE 8XX Special Studies (4-2) NC
M.S. students choose and study a topic under the guidance of faculty member, normally his/her advisor.

FDE 9XX Advanced Studies (4-0) NC
Graduate students as a group or a Ph.D. student choose and study advanced topics under the guidance of faculty member, normally his/her advisor.