

## DESCRIPTION OF UNDERGRADUATE COURSES

- FDE 101 Introduction to Food Engineering (1-0)1**  
Scope, definition and historical development of food engineering. Principles of biological and physical sciences related to the food systems. Introduction to structure and properties of food materials, preservation techniques and engineering aspect of food processing from harvest to packaging and distribution.
- FDE 201 Material and Energy Balances (4-0)4**  
Systems of units and dimensions. Material balances for processes with and without chemical reaction. Gases and vapors, saturation and humidity. Energy balance, physical and chemical heat effects, use of steam tables. Simultaneous material and energy balances. Engineering ethics, responsibilities, health and safety considerations.
- FDE 224 Food Engineering Operations I (4-0)4**  
Introduction to unit operations of food engineering and momentum transfer. General concepts of fluid flow. Newtonian and non-Newtonian fluids. Macroscopic mass, momentum and energy balances. Friction factors, flow around submerged objects. Dimensional analysis. Flow metering and transport devices. Fluid mixing. Engineering ethics, responsibilities, health and safety considerations.  
*Prerequisite: FDE 201.*
- FDE 300 Summer Practice I NC**  
Twenty working days of practical training in a plant designated or approved by the Department. A final report is required at the end of the training period.  
*Prerequisite: FDE 201.*
- FDE 305 Food Microbiology Laboratory (0-2)1**  
Basic techniques for handling microorganisms in the laboratory. Methods for obtaining pure cultures, enumeration, detection and control of microorganisms in foods through case studies. Assessment of quality by microbiological analysis.  
*Corequisite: FDE 311.*
- FDE 310 Food Materials Laboratory (0-2)1**  
Laboratory experiments on chemical and physical characterization of food materials with regard to chemical composition, structure and functionality. Chemical and physical changes during processing, physical and chemical stability of processed foods.  
*Corequisite: FDE 314.*
- FDE 311 Food Microbiology (3-0)3**  
Relationship of microorganisms to foods. Characteristics of predominant microorganisms in foods. Sources and significance of microorganisms in foods. Food born pathogens. Indices of food sanitary quality and microbiological standards. Presence of viruses in foods. Sporulation and sporulating organisms in foods.  
*Prerequisite: BIO 107 or (GENE 103 and 104)*
- FDE 312 Food Processing (3-0)3**  
A study of the basic methods by which foods are preserved. Commercial methods of canning, freezing, irradiation, dehydration. Packaging and storage of foods.  
*Prerequisite: FDE 321.*
- FDE 313 Food Chemistry (3-0)3**  
Chemistry of major and minor components of food materials. Effects of changes in the chemical properties of food components on their functional, nutritional and physical properties. Inter- and intra-molecular associations and their functions. Complex enzymatic and chemical reactions involving food components and the effect of these reactions on the properties of food systems.  
*Prerequisites: BIO 107 and CHEM 229*
- FDE 314 Physical Properties of Food Materials (3-0)3**  
Characterization of food materials with regard to their functionality, rheological, thermal and electrical properties. Colloidal food systems and functionality of food components as emulsifiers, stabilizers, texturizers, gelling and foaming agents. Measurement of physical attributes of food materials such as size, shape, volume, surface area, density, porosity and shrinkage. Importance of water activity and sorption properties of food materials.  
*Prerequisites: CHE 204 and FDE 313.*
- FDE 318 Biochemical Changes in Raw Foods (3-0)3**  
Biochemistry of raw foods: red meat, poultry, fish, eggs, post-harvest physiology of fruits and vegetables, cereals, legumes, milk, toxicants and contaminants. Interactions in colloidal systems, chemistry of browning reactions and lipid oxidation reactions, glass transition and state diagrams of foods.  
*Prerequisite: FDE 313.*
- FDE 320 Applied Kinetics (3-0)3**  
Rate of a chemical reaction. Kinetics of biological reactions. Kinetics of biomass production, substrate utilization and product formation in cell cultures. Kinetics of microbial death and enzyme

inactivation. Design and analysis of biological reactors. Immobilized biocatalysts, reaction with diffusion.

*Corequisite: FDE 313.*

**FDE 321 Food Engineering Operations II (4-0)4**

Fundamentals of heat transfer, principles of conduction, convection and radiation. Empirical models for the evaluation of heat transfer coefficients. Heat transfer operations in food engineering with emphasis on heat exchange in non-Newtonian flow, boiling and condensation, evaporation, and concentration, pasteurization and sterilization, cooking and cooling, freezing. Engineering ethics, responsibilities, health and safety considerations.

*Prerequisites: FDE 224 and MATH 219.*

**FDE 322 Applied Food Microbiology (3-0)3**

Introduction to beneficial uses of microorganisms in food industry through case studies. Bacteriophage problems in starter cultures. Use of probiotics.

*Prerequisite: FDE 311.*

**FDE 324 Food Engineering Operations III (4-0)4**

Fundamentals of mass transfer, principles of diffusion, convection and phase equilibria. Principles of absorption, distillation, extraction, leaching, drying, crystallization, adsorption and membrane processes with emphasis on food industry and engineering ethics, responsibilities and safety considerations.

*Prerequisites: Math 219, CHE 204 and FDE 224.*

**FDE 400 Summer Practice II NC**

Twenty working days of practical training in a plant designated or approved by the Department. A final report is required at the end of the training period.

*Prerequisite: FDE 300.*

**FDE 403 Food Biotechnology (3-0)3**

An introduction to the basic concepts of biotechnology, classical versus modern biotechnology, properties and utilization of biological organisms, bioreactors, and bioengineering, downstream processing, modern food biotechnology applications.

*Prerequisite: FDE 313.*

**FDE 407 Process Control Applications in Food Engineering (3-0)3**

Importance of process control in the manufacture of processed foods with desired shelf-life and acceptable quality, application of process control principles to handle the complexity of food systems

leading to difficulties in modeling and simulation. Simulation and control of selected food processing operations.

*Prerequisites: FDE 321 and FDE 324.*

**FDE 412 Engineering Principles of Fermentation Technology (3-0)3**

Production of food and food ingredients through fermentation processes. Aerobic and anaerobic systems, batch versus continuous operations, bioreactor design and operation, microbial kinetics, engineering principles of baker's yeast, pickles and olives, industrial enzymes, flavorings, vitamins, alcoholic beverages, organic acid and amino acid production.

*Prerequisite: FDE 320.*

**FDE 413 Food Technology (3-0)3**

Raw materials, handling, processing, packaging, storage and distribution of food products; cereal technology, fruit and vegetable processing, meat technology, poultry and egg technology, seafood technology, milk and dairy technology, baking and pasta technology, fat and oil technology, sugar and candy technology, cocoa and chocolate technology, coffee and tea technology, alcoholic and non-alcoholic beverage technology.

*Prerequisite: FDE 321.*

**FDE 415 Food Plant Sanitation (3-0)3**

The role of sanitation in food industry, the relationship of microorganisms to sanitation. Introduction to Hazard Analysis and Critical Control Points (HACCP). Sanitation practices in different food processing systems, cleaning compounds, sanitizers, waste product handling.

*Prerequisite: FDE 311.*

**FDE 416 Food Engineering Operations Laboratory (1-4)3**

Experiments on a variety of food engineering operations (drying, extraction, pasteurization, filtration, size reduction, centrifugation, fluid flow, fermentation). Experimental design, analysis and interpretation of data in the form of written reports.

*Prerequisites: FDE 321 and FDE 324.*

**FDE 418 Chemistry of Food Preservation and Packaging (3-0)3**

Chemical preservation methods: use of antimicrobials, antioxidants, curing agents. Preservation by using polymers: design and use of encapsulation systems and edible coatings and films. Preservation through food packaging. Types of packaging materials used, engineering principles of packaging, food-package interactions, recent advances in packaging, applications of nanotechnology in food packaging.

*Prerequisite: FDE 313.*

**FDE 425 Food Engineering Design (2-2)3**  
Engineering ethics, responsibilities, health and safety considerations. Design and optimization of equipment used in food industry through case studies. Optimization of operational conditions. The principles of engineering operations are extensively utilized in a design report for each case including a technical specification sheet.

*Prerequisites: FDE 320 , FDE 321, FDE 324 and CHE 423.*

**FDE 426 Food Product and Plant Design (2-2)3**

Engineering ethics, responsibilities, health and safety considerations. Selection of a novel product and a process from food industry through market survey. Food product development. Selection of the location, preparation of the plant layout, material and energy balances. Design of the major units and sizing of the ancillary equipment including services, health and safety considerations. Plant and product cost estimation.

*Prerequisites: FDE 320, FDE 321, FDE 324 and CHE 423.*

**FDE 431 Food Quality Control (3-0)3**

Principles of quality control system design in a food plant with emphasis on quality control circles and feed-back loop concept. Review of the statistical background of quality control as applied to food quality factors. Quality control charts for measurements and attributes as applied for foods and beverages. Sampling techniques and acceptance sampling plans. Design of experiments and application of HACCP in the food industry.

*Prerequisite: ES 303.*

**FDE 432 Sensory Analysis (3-0)3**

Sensory attributes of foods; appearance, odor, flavor and feel of different products and the mechanisms by which those attributes are perceived. Visual, olfactory, gustatory and tactile/kinesthetic senses. Psychophysical senses will be scaled, measured, analysed, interpreted to product characteristics. Principles of taste and odor testing, physical methods of color and texture measurements. Training sensory panels, questionnaire design analysis, difference testing, threshold and dilution tests, ranking tests. Descriptive and rating methods, hedonic tests.

*Prerequisite: ES 303.*

**FDE 434 Drying of Foods and Dryers (3-0)3**

Importance of drying in food industry and dried products. Fundamental conservation rules of drying as a simultaneous heat and mass transfer operation. Humidity and the psychrometric chart, water sorption and desorption isotherms, theoretical relations and their importance on the operation. Effect of food structure on the expected mechanism of drying and methods to estimate the behavior. General types of dryers used in food industry. Spray, freeze and other special dryers. Drying by microwaves. IR and integrated systems. Design and control of dryers for batch and continuous operations.

*Prerequisite: FDE 324.*

**FDE 483 Food Markets and Legislation (3-0)3**

Introduction to microeconomics; consumer and producer economics; food market equilibrium; trade and welfare; global food market structure; world trade rules; global food regulatory framework; food legislation; EU compliance of Turkish food legislation; competitiveness of food sector.

**FDE 484 Engineering Principles of Novel Food Preservation Technologies (3-0)3**

Definitions of thermal and non-thermal processing technologies; ohmic heating, microwave heating, high hydrostatic pressure treatment, pulsed electric field treatment, irradiation and high intensity light treatment. Engineering principles of novel food preservation technologies.

*Prerequisite: FDE 321.*

**FDE 490 Food Engineering Research (1-4)3**

Application of knowledge, abilities and creativity to a research topic, involving either a market survey, an experimental study in the laboratory or participation in an existing project. Research projects are presented by a final report and a seminar at the end of the semester.

*Prerequisite: Fourth year standing.*

**FDE 491-495 Special Topics in Food Engineering (3-0)3**

These code numbers will be used for technical elective courses which are not listed regularly in the catalog. The course contents will be announced before the semester commences.

*Prerequisite: Consent of the department*