

**İZMİR INSTITUTE OF TECHNOLOGY**  
**FACULTY OF ENGINEERING, FOOD ENGINEERING DEPARTMENT**

**DESCRIPTION OF MANDATORY COURSES**

**MATH 141 Basic Calculus I (3+2) 4**

Functions. Limits and continuity. Derivatives. Applications of Derivatives; Mean Value Theorem, Intermediate Value Theorem. Integration. Applications of Integrals; Volumes by slicing, Surface areas and Arc lengths, Transcendental functions. Integration Techniques; Substitution Rule, Trigonometric integrals, Integration by parts.

**PHYS 121 General Physics I (3+2) 4**

Basic concepts of mechanics using vectors and calculus; Newton's laws of motion; conservation of energy and momentum. Kinematics and dynamics of particle and rigid bodies undergoing rectilinear, rotational, and oscillatory motion. Gravitation. Laboratory experiments complement the lectures.

**MBG 101 Biology I (3+0) 3**

The complex biological molecules and cellular structures, concepts of biological processes such as metabolism, inheritance, and cell communication at both molecular and cellular levels: Chemical context of life, water and life, carbon and molecular diversity of life, the structure and function of large molecules, cells and membrane structure and function, an introduction to metabolism, cellular respiration and fermentation, photosynthesis, cell communication, the cell cycle, meiosis and sexual life cycles, Mendel and gene idea, the chromosomal basis of inheritance, the molecular basis of inheritance, from gene to protein, regulation of gene expression, viruses, biotechnology, genomes and their evolution.

**CHEM 121 General Chemistry I (3+0)3**

Matter-its properties and measurement. Atoms and atomic theory. Chemical compounds. Chemical reactions. Introduction to reactions in aqueous solutions. Gases. Thermochemistry. Electrons in atoms. The periodic table and some atomic properties. Chemical bonding. Liquids, solids and intermolecular forces. Solutions and their physical properties.

**CHEM 141 General Chemistry Lab. I (0+2)1**

Experiments are related to the topics covered by CHEM 121 Course.

### **ENG 101 Development of Reading and Writing Skills I (3+0) 3**

The overall aim of this course is to develop freshman students' English academic reading and writing skills. The course also aims at equipping students with basic study skills they will need throughout their academic life. Students are encouraged to write and present what they read; therefore, speaking skills are introduced and make the students use them while presenting a topic.

### **FE 105 Introduction to Food Engineering (2+0) 2**

This course aims to introduce the food engineering profession, the curriculum of the food engineering programme; the basic concepts used in food engineering and the Turkish food industry. Scope, definition of food engineering. Principles of biological and physical sciences related to the food system. Introduction to structure and properties of food materials, preservation and engineering aspect of food processing from harvest to packaging and distribution

### **MATH 142 Basic Calculus II (3+2) 4**

L' Hospital's Rule. Improper Integrals; Tests for Convergence. Sequences and Infinite series; Tests for Convergence. Multivariable Functions and Their Derivative; Limits. Directional Derivative, Gradient Vector, Double Integral, Double Integral in Polar Coordinates.

### **PHYS 122 General Physics II (3+2) 4**

Continuation of General Physics I. The fundamental laws of electricity and magnetism, including electromagnetic oscillation and applications to circuits and instruments. Coulomb's law; electric fields; Gauss's law; electric potential; capacitance. Simple circuits; RC circuits. Magnetic force; forces and magnetic dipoles; magnetic field; Faraday's law; self-inductance. Laboratory experiments complement the lectures.

### **CHEM 122 General Chemistry II (3+0)3**

Chemical kinetics. Principles of chemical equilibrium. Acids and bases. Solubility and complex ion equilibria. Entropy and free energy. Electrochemistry. Nuclear chemistry. Main group elements I: metals, main group elements II: nonmetals. Complex ion and coordination compounds. Transition metals.

### **CHEM 142 General Chemistry Lab. II (0+2)1**

Experiments are related to the topics covered by CHEM 122 Course.

### **ENG 102 Development of Reading and Writing Skills II (3+0)**

The overall aim of this course is to develop freshman students' English academic writing skills, evaluating original articles and to make them able to write an original article about their own opinions on that topic. Students are encouraged to present what they have written.

### **FE 104 Fundamentals of Nutrition (3+0) 3**

This introductory course provides basic information of nutrients including food sources, function of nutrients, digestion, and absorption, effects of deficiency and upper levels of nutrients, nutrient requirements for the life cycle, nutrient-nutrient interactions in human physiology, food origins and form, consumer behavior and clinical nutrition.

### **MATH 255 Differential Equations (4+0) 4**

First order equations and various applications. Second order linear equations. Higher order linear differential equations. Power series solutions: ordinary and regular singular points. The Laplace transform: solution of initial value problems. Systems of linear differential equations: solutions by operator method, by Laplace transform. Fourier series and boundary value problems.

### **CHEM 221 Organic Chemistry (4+0) 4**

Carbon compounds and chemical bonds, alkenes, cycloalkanes, alkanes, alcohols, ethers, radical reactions, aromatic compounds, conformational analysis, stereo chemistry, nucleophilic substitution.

### **CHEM 201 Analytical Chemistry I (3+0) 3**

Fundamental theories and principles of quantitative methods of analysis. errors in chemical analysis and statistical treatment of analytical data. Gravimetric methods of analysis. Titrimetric methods of analysis. Aqueous-solution chemistry and effect of electrolytes on ionic equilibria. An introduction to electrochemistry. Theory of neutralization, precipitation, complex-formation, and oxidation/reduction titrations.

### **FE 201 Material and Energy Balances in Engineering (3+0) 3**

Units and dimensions, conversion of units, types of processes, flow diagrams, material balances and calculations in steady-state systems, behaviors of gas and vapor systems, types of energy, energy balances and calculations in open and closed systems, psychrometric charts, humidification and cooling processes.

### **ECON 205 Principles of Economics (3+0) 3**

Definition of economics, general view of price system, market and price, macro economics, definition of GNP. Fiscal and monetary policy, international trade. Development and growth.

### **TURK 201 Turkish Language I (2+0) 0**

The course is organized to make students understand the structure and principles of contemporary Turkish language with living examples and to increase their interest in Turkish literature. Development of the students' writing and fluent speaking capabilities, increasing their vocabularies, improving their capacity to criticize, to comment, to create and development of their ability to gain habit of positive thinking.

### **HIST 201 Principles of Atatürk I (2+0) 0**

Discusses the modernisation of the Ottoman Empire during the nineteenth and early twentieth centuries, the spread of nationalism among its subject peoples, and the revolutionary changes in Ottoman institutions and society that led to the Empire's demise and the transitional period from the Empire to the national state and the foundation of the Turkish Republic following the national struggle led by Mustafa Kemal Atatürk.

### **FE 202 Fluid Mechanics (3+0) 3**

Fluid statistics, fluid dynamics, viscosity and boundary layer theory. Newtonian and non-Newtonian fluid behavior. Application of equation of continuity and equation of motion to fluid flow systems. Exact solutions of the Navier-Stokes equations. Mechanical energy balances. Bernoulli equation. dimensional analysis and dynamic similarity.

**Prerequisites:** FE 201

### **FE 204 Numerical Methods in Engineering (3+0) 3**

Introduction to MATLAB; Matrix operations; Solutions of linear and nonlinear algebraic equations; Linear and nonlinear regression; Numerical differentiation and integration; Finite difference method; Initial and boundary value problems

### **FE 206 Food Microbiology (3+2) 4**

Importance of microorganisms in foods. Intrinsic and extrinsic factors in foods affecting microbial growth. Indicator microorganisms. Contamination and spoilage of different foods. Chemical changes in foods caused by microorganisms. Microbial metabolism, microflora of food commodities with special emphasis on food spoilage and food safety. Beneficial microorganisms and their use in food industry. Food-borne pathogens and diseases. Microbial food poisoning, infection and intoxication. Indices of food sanitary quality and microbiological standards. Conventional and new microbial counting and detecting methods.

Control of microbial growth in foods. Food preservation methods. Cleaning, disinfection and sanitation. GMP, GHP, SSOP and HACCP system.

Lab: Basic techniques for handling microorganisms in the laboratory. Laboratory experience on basic principles of microbiological analysis of foods. Methods for obtaining pure cultures, enumeration, detection and control of microorganisms in foods through case studies. Isolation identification and enumeration techniques of the main food-borne pathogenic and indicator microorganisms, and lactic acid bacteria. Genetic based rapid techniques in food microbiology. Assessment of food safety and quality by microbiological analysis.

### **TURK 202 Turkish Language II (2+0) 0**

Grammatical and linguistic knowledge, poems, stories, novels and essays written by the Turkish and international writers who use the language most skillfully. Besides, some panels and conferences are held related to the books selected.

### **HIST 202 Principles of Atatürk II (2+0) 0**

Discusses major events that had taken place from 1923 to 1950, the structuring of the Republic of Turkey and the political, social, economic, and cultural revolutions introduced by Mustafa Kemal Atatürk.

### **FE 210 Introduction to Statistics for Engineers (3+0) 3**

Data collection, graphical and numerical descriptive statistics to summarize and present data, definition and laws of probability, basic probability distributions for discrete and continuous variables, random sampling and statistical inference, hypothesis testing and confidence intervals for analyzing means and variances, analysis of variance (ANOVA), linear regression.

### **FE 301 Heat Transfer (3+0) 3**

Steady and unsteady heat conduction. Convective heat transfer: governing equations; dimensionless parameters; analogy between momentum and heat transfer. Design correlations for forced, natural, and mixed convection. Heat exchangers. Radiative heat transfer.

**Prerequisites:** FE 201, FE 202

### **FE 303 Thermodynamics (3+0) 3**

Fundamentals of thermodynamics; Properties of pure substances; Heat and work concepts; First Law of thermodynamics in open and closed systems; Second Law of thermodynamics in open and closed systems; Entropy; Power cycles and refrigeration; Thermodynamic properties of real substances

**Prerequisites:** FE 201

### **FE 305 Food Chemistry (3+2) 4**

Structure and properties of food components (water, carbohydrates, proteins, lipids, others). Chemical and biochemical reactions of food constituents in fresh and processed foods. The chemistry and biochemistry of changes occurring during processing and storage of foods. Functional properties of food components. Basis of chemical methods used in quantitative and qualitative determination of moisture, carbohydrates, proteins, lipids, enzymes and coloring and flavoring compounds.

### **ENG 301 Technical Writing and Communication (3+0) 3**

Methods of library research. Principles of clear writing related to technical style; problems such as technical description and technical correspondence. Techniques for the preparation of research papers, reports and term papers. A discussion of the basics of scientific writing style and composition. Principles and procedure of technical writing; attention to analyzing audience and purpose, organizing information, designing graphic aids, and writing such specialized forms as abstracts, instructions, and proposals. Application of these principles to writing research papers and review articles, grant proposals, research statements and to preparing academic oral and poster presentations. Developing oral communication skills by using rhetorical strategies such as narration and argument; communication practices on selected topics, preparing oral reports; drafting, revising, editing; evaluation and proper documentation of source material.

### **FE 302 Mass Transfer (3+0) 3**

Fick's Law of molecular diffusion; Diffusion in gases, liquids and solids; Diffusion with homogeneous and heterogeneous reaction; Equation of continuity for a Binary Mixture; Convective mass transfer; Models to predict mass transfer coefficients; Analogy between momentum, heat and mass transfer; Unsteady state mass transfer; Phase equilibria; Mass transfer between phases; Overall mass transfer coefficients; Absorption; Distillation; Extraction; Leaching; Drying; Membrane separations.

**Prerequisites:** FE 201, 202, 301, 303

### **FE 304 Unit Operations in Food Processing (3+4) 5**

Unit Operations in Food Processing e.g. thermal processing (pasteurization, sterilization), dehydration, freezing, extraction, physical separation, mixing, comminution and irradiation, including effects on product quality.

### **FE 307 Nutritional Biochemistry (3+0) 3**

After we consume nutrients from diet, they are used for energy source in cells of body. Energy is necessity to survive for living organism. This course will cover the macronutrients including carbohydrates, lipids, protein, fiber and alcohol. The course will also addresses energy metabolism. It will discuss the structure and function of the macronutrients and fiber; the digestion, absorption and metabolism of macronutrients, fiber, and alcohol. Utilization of the major nutrients emphasizing regulatory mechanisms at organ and cellular levels under various physiological conditions also will be discussed in this course.

### **FE 310 Food Technology (3+0) 3**

This course is related to technologies applied during preparation, transportation, storage and processing of food. The course focuses on principles of major technologies including packaging, cold storage, freezing, drying and thermal processing. Moreover, the general technologies used during processing of fruits and vegetables, cereals, oils and meat and meat products are also summarized.

### **FE 316 Applied Nutrition in Food Science (2+2) 3**

This course will focus clinical approaches to determine importance of the nutrients in human health, introduction of in vivo, ex vivo, in vitro study models that can be applied in food science, determination of nutrients and functional molecules bioaccessibility in foods, showing of steps in cell culture studies, modeling of human intestine system in in vitro and using of this model in bioavailability studies

### **FE 400 Summer Practice (NC)**

The course includes the activities and education conducted in an institution in the field of Food Engineering or related areas.

### **FE 401 Principles of Food Safety and Quality Assurance (3+2) 4**

Principles of food safety; Causes and prevention of food spoilage; Theories and applications of quality assurance, functions of a quality assurance program; Regulatory and technical aspects of quality assurance and quality control in the food processing plants and quality assurance/control laboratories; Statistical quality control; Management of food safety and quality by industry, food quality systems including HACCP, safe food handling, total quality management, ISO quality standards, food safety systems in the food processing plants.

### **FE 403 Food Product and Process Design (2+4) 4**

A project-based, senior design course focused on design aspects of food products from a product and process perspective. This course will help students to understand the food product design based on the integrated technological, regulatory, safety and economic analysis. Students will be required to access resources in a variety of ways to acquire the knowledge necessary to successfully complete their project assignment. Course topics include development of product formula or selection of a novel product and a process from food industry through market survey, concept generation prototype development, scale-up, product optimization, package design, and raw material sourcing.

#### **Prerequisites/Recommended:**

FE 202 Fluid Mechanics, FE 301 Heat Transfer, FE 302 Mass Transfer, FE 304 Unit operations in Food Processing, ECON 205 Principles of Economics

### **FE 421 Graduation Project (0+6)3**

The project may be survey study or computer aided design or laboratory work based on experimental or theoretical study on Food Engineering. A review topic about the previous literature studies could be presented as a graduation project. Lecture will be conducted by the related instructor for one year term.

### **FE 402 Nutrition in Health and Diseases (3+0) 3**

This course focuses mainly on relation of modern diseases such as coronary heart disease, stroke, atherosclerosis, Type 2 diabetes, obesity, hypertension and cancer with diet; diseases and nutrition support; healthy eating, sustainable nutrition; recommended and nonrecommended food and their health effects; nutrition through the life cycle; developing strategies in preventing or slowing diseases and bioactive compounds in food and their health benefits.

### **FE 404 Instrumental Analysis in Food and Nutrition (2+2) 3**

Sample preparation methods for food analyses. Theoretical principles and applications of spectroscopic and chromatographic techniques used in food analyses. Introduction of techniques that are used to investigate effects of nutrients on human physiology.

## **TECHNICAL ELECTIVE COURSES**

### **FE 308 Functional Foods (3+0) 3**



This course discusses the components, mechanism of action and health effects of functional foods. Chemistry and physiological effects of functional foods. Application of functional materials. Development of functional foods from novel sources or traditional foods with value-added health benefits. Bioavailability, diet and gut health. Biomarkers, safety and efficacy testing, and regulations.

### **FE 311 Principles of Food Packaging (3+0) 3**

This course focuses on the functions of the food packaging. Other issues discussed are physical, chemical and barrier properties of packaging materials, applications of various materials used in the packaging of foods and specific packaging requirements for different food products.

### **FE 312 Introduction to Industrial Microbiology (3+0) 3**

This course deals with microbial cell structure and function, microbial growth and metabolism, industrial microorganisms, fermentation media, fermentation systems, downstream processing, product development, regulation and safety, industrial processes and products.

### **FE 313 Food Additives (3+0) 3**

The course discusses the functions of food additives and principles using food additives in different foods. The regulations and practices of using food additives in Turkey and in other countries, the contributions and the limitations of food additives in a food supply, and the methods used for evaluating the safety of food additives are other issues discussed in the course.

### **FE 314 Food Enzymes (3+0) 3**

The course discusses the general structure, conformation and catalytic properties of enzymes, principles of enzyme kinetics, enzyme activation and inactivation methods, major food enzymes related to quality and roles of enzymes in nutrition.

### **FE 318 Introduction to Food Biotechnology (3+0) 3**

The general topics of this course include definition of food biotechnology, principles of food processing and preservation using bio-based methods, treatment of agricultural and agroindustrial wastes, food fermentations (production of nutrients, fermented food stuffs, processing aids, flavours, functional food ingredients etc.), culture collections, enzyme fermentation technology and immobilized enzymes, application of enzymes in food industry. The GMO and international trade, patent rights, national and international regulations are also discussed as separate topics.

### **FE 405 Microbiological Quality Control (2+2) 3**

This course discusses mainly the foodborne microbial diseases, food spoilage and its control and microbiological quality control in food chain. The sampling and sampling plans, preparation of food homogenates and microbiological analysis are also discussed with details. Other topics include microbiological standards and methods used in the microbiological quality control of foods, and application of microbiological quality control in food products.

**Prerequisite:** FE 206

### **FE 406 Principles of Food Preservation (3+0) 3**

This course is an introduction to food preservation methods. General methods for short and long term preservation are discussed with particular emphasis on thermal processing, refrigeration, freezing, concentration, drying, fermentation and irradiation. The effects of different preservation methods on physical, chemical and organoleptic changes of food products as well as roles of food packaging in the preservation of food products will also be discussed with details. Novel emerging technologies including pulsed electrical fields, pulsed light, high pressure processing, microwave and radio frequency, inductive and ohmic heating, high voltage arc discharge, oscillating magnetic fields and ultrasound will also be introduced and research needs in these processing technologies will be emphasized.

### **FE 407 Engineering Properties of Foods (2+2) 3**

This course focuses on relationships between composition, structure and physical properties of foods. Measurement methods and the use of physical, mechanical, rheological, thermal, electromagnetic, surface and interface properties in the design of new applications and product development are discussed and demonstrated with laboratory experiments.

### **FE 409 Methods in Nutritional Sciences (3+0) 3**

This course is related to principles of in-vivo and in-vitro analytic, biochemical and molecular methods as well as biostatistical methods used in nutritional research studies. The preparation of biological materials for analysis, methods for adsorption, digestion and metabolism of nutrients, test of health benefits of food (antioxidant, antihypertensive and antidiabetic activity, anticarcinogenic activity etc.) with chemical, enzymatic and cell culture methods, and nutrient, metabolite, and enzyme analysis in body fluids are the major topics discussed in this course.

### **FE 410 Introduction to Nutrigenomics and Nutrigenetics (3+0) 3**

The content of this course includes classical and recently discovered examples to understand interaction of diet and nutraceuticals with genes and health, possibility of modifying disease risks through nutrigenetics and nutrigenomics, personalized nutrition, application of nutrigenomics in product development, and major technologies used in nutrigenomics and nutrigenetics.

### **FE 411 Research/Problems in Nutrition (3+0) 3**

This course focuses on understanding current nutrition strategies, emerging issues and research in nutrition and global nutrition problems, and helps students to develop novel approaches to use science and technology in solution of nutrition problems. The course encourages students to follow very recent developments in nutrition, discover scientific and technological solutions for nutritional problems and make interactive discussions in class with other students and tutor.

### **FE 412 Introduction to Nutritional Epidemiology (3+0) 3**

This course focuses on monitoring the nutritional status of populations and developing healthful eating patterns among populations. The content of the course includes the principles of nutritional epidemiology, design, planning and evaluation of nutritional epidemiology studies, principles of sampling, determining study size and power of epidemiological study, covariate measurement errors in nutritional epidemiology and measurement of exposure and outcome by considering consumption tables, nature of variation in diet, food frequency methods, biochemical markers of food intake and gene-nutrient interactions.

### **FE 413 Quality Management Systems (3+0) 3**

Quality concept and related definitions; national and international standards and legislation concerning food quality; quality assurance systems and total quality management in food industries; quality management tools; quality criteria, their respective limits and quality monitoring systems for different food commodity groups; relevant ethical issues

### **FE 414 Process Dynamics and Control (3+0) 3**

The course is designed to develop an understanding of the fundamentals of dynamic modeling, design and analysis of classical feedback control of chemical processes. Dynamic modeling; Input and outputs; State variables; Laplace transforms; Transfer functions; Stability; Feedback controllers and closed-loop systems; Routh-Hurwitz criterion and Root Locus diagrams are the major topics discussed in the course.

**Prerequisite:** FE 301, FE 302

### **FE 415 Sensory Analysis in Foods (3+0) 3**

This course discusses the anatomy and physiology of the sensory systems, physiological and psychological factors that affect performance on sensory tests, basic scaling procedures, thresholds, selection of panelists, basic discrimination/difference tests, descriptive tests, and consumer tests. Detection of sensorial properties of foods using instrumental methods and correlation with sensory analysis, data analysis and interpretation of results and design of sensory panel rooms are other chapters.

### **FE 416 Reaction Kinetics in Food Engineering (3+0) 3**

This course discusses the aspects of kinetic modelling, types of reactions and reaction mechanisms in foods and biochemical systems, determination of reaction rate constants, factors effecting reaction kinetics, kinetics of microbial growth and death, enzyme inactivation and enzyme kinetics.

### **FE 417 Special Topics in Food Engineering and Nutrition (3+0) 3**

This is a flexible course which discusses the emerging problems, technologies and methods in food engineering and nutrition. The course aims improving the knowledge of students about the latest topics in the specified fields and increases their vision beyond the classical knowledge.