INTRODUCTION TO FOOD SCIENCE AND TECHNOLOGY

PROF. DR. ARTEMİS KARAALİ

Office: G-420

Phone: 285 60 38

e-mail: karaali@itu.edu.tr

COURSE OBJECTIVES(ABET*)

- Get introduced to food chemistry, food microbiology, food processing, and the unit operations involved;
- Create an awareness of engineering ethical responsibility;
- Write and speak with effective communication skills in preparation of homework assignment.

- *ABET:"Accreditation Board for Engineering and Technology": The recognized accreditor for college and university programs in applied science, computing, engineering, and technology (a federation of 31 professional and technical societies representing these fields).

Strategies and Actions	Student Learning Outcomes
Lectures are based on syllabus. A textbook is assigned to students at the beginning of the semester.	**-Demonstrate a basic understanding of food engineering profession and education.** **-Demonstrate a basic knowledge of food manufacturing processes.** **-Develop an awareness of ethical responsibility.**
Students are grouped into 2 or 3. Each group is assigned to prepare a paper on specific topic given by the instructor, which is presented both orally and written format at the end of semester. Students evaluate the oral presentation quality of each group individually.	**- plan and deliver presentation effectively,** **- organize written materials in a logical format.** **-share information with others.** **- scale down the information to what is important.** **-demonstrate an ability to read and write English.** **-evaluate one's performance critically and accurately.**

COURSE SYLLABUS

Course Content

1. Scope of Food Science and Food Technology
   Food Science as a Discipline, Characteristics of the Food Industry, Hunger, Technology and World Food Needs
2. Food Components: Food Chemistry and Nutrition
   Carbohdyrates, Proteins, Fats and Oils, Vitamins, Minerals, Water, Fiber, etc.
3. Food Decay and Traditional Methods for its Prevention
   Shelf-life and Dating of foods, Major Causes and Prevention of Deterioration
4. Unit Operations in Food Processing
   Handling, Cleaning, Separating, Pumping, Mixing, Heat Exchanging, Evaporation, Drying, Packaging, New Processes

Course Content

5. Practical Technology and Food Quality
   Appearance factors, Textural factors, quality standards
6. Milk, Cheese and Eggs
   Milk, and its derivatives, cheese, ice cream, eggs
7. Meat, Fish and Poultry
   Meat and meat products, poultry, marine fish, shellfish etc.
8. Fats and Oils
   Sources of fats and oils, functional properties, production and processing methods, fat substitutes
9. Cereals and Cereal Products
   Cereal grains, principles of baking
10. Fruits-vegetables and Their Products
    Harvesting and processing of fruits and vegetables, fruit juices

COURSE SYLLABUS

Course Content

11. Beverages and Confectionary Products

Carbonated non-alcoholic beverages, beer, wine, coffee, tea, sugar based confections, chocolate and cocoa products

12. Food Safety: Risks and Hazards

Safety, hazards and risks, microbial considerations, HACCP, chemical hazards

13. Quality Control and Legislative Aspects

Food laws, legal categories of food substances, testing for food safety, food labeling, International Food Standards and Codex Alimentarius

14. Student Presentations on Selected Special Issues

COURSE SYLLABUS

GRADING OF COURSE:

Homework Assignment	20%
Midterm Examination	30%
Final Examination	50%

Final exam requirement: 70% of attendance is a must to take the final exam

Course Project: One assigned topic for each student to be prepared for submission in written report format and to be presented orally

COURSE SYLLABUS

TEXTBOOK

- Potter, Norman and H. Hotchkiss, 1995. Food Science, 5th ed., Chapman and Hall, USA.

REFERENCE BOOK

- Pyke, Magnus: Food Science and Technology

ETHICAL BEHAVIOUR

- Copying from others or providing answers or information, written or oral, to others is **CHEATING**.

- Copying from another student's paper or from another text without written acknowledgement is **PLAGIARISM**.

- Unauthorized help from another person or having someone else write one's paper or assignment is **COLLUSION**.

- Cheating, plagiarism and collusion are serious offences resulting in an:F grade and disciplinary action.

1 SCOPE OF FOOD SCIENCE AND FOOD TECHNOLOGY

FOOD SCIENCE

✓Application of the basic sciences and engineering to study the fundamental physical, chemical and biochemical nature of foods and the principles of food processing.

Food Chemistry

Food Microbiology

Food Quality Control

1 SCOPE OF FOOD SCIENCE AND FOOD TECHNOLOGY

FOOD TECHNOLOGY

✓ Food technology is the use of the information generated by food science in the selection, preservation, processing, packaging and distribution, as it affects the the consumption of safe, nutritious and wholesome food.

Process Control

Fluid Mechanics

Food Processing Operations

1 SCOPE OF FOOD SCIENCE AND FOOD TECHNOLOGY

Food science is a multi-disciplinary fields of science:

- ✓Food Microbiology
- ✓Food Engineering
- ✓Food Chemistry
- ✓Sensory Analysis
- ✓Biochemistry
- ✓Nutrition
- ✓Chemistry
- ✓Biology
- ✓Biotechnology
- ✓Agriculture
- ✓Mechanical Engineering
- ✓Chemical Engineering

1 SCOPE OF FOOD SCIENCE AND FOOD TECHNOLOGY

Scope of Food Science and Technology includes:

✓ Efforts to make it possible to supply great quantities of food to crowded populations (result of urbanization)

✓ Efforts to develop new (novel) foods agreeable to consumers (increase type, availability at all times)

✓ To maintain (if possible to improve) nutritional value and quality of foods.

FOOD ENGINEERING EDUCATION AND CURRICULUM

The core of food science and technology courses includes both lecture and laboratory components:

Food Chemistry: Basic composition, structure and properties of foods, chemistry of changes occurring during processing and utilization.

Food Analysis: Principles, methods and techniques for quantitative physical, and chemical analyses of food products and ingredients.

1 SCOPE OF FOOD SCIENCE AND FOOD TECHNOLOGY

FOOD ENGINEERING EDUCATION AND CURRICULUM

Food Microbiology: Microbial ecology related to foods, effects of environment on food spoilage and food manufacture, physical, chemical and biological destruction of microorganisms in foods, microbial examination of food stuffs, public health and sanitation microbiology.

Food Processing: General characteristics of raw materials, principles of food preservation, processing factors which influence quality, packaging, water and waste management, good manufacturing practices, sanitation procedures.

1 SCOPE OF FOOD SCIENCE AND FOOD TECHNOLOGY

FOOD ENGINEERING EDUCATION AND CURRICULUM

Food Engineering: Study of engineering concepts, unit operations in food processing, material and energy balances, thermodynamics, fluid flow, heat and mass transfer.

1 SCOPE OF FOOD SCIENCE AND FOOD TECHNOLOGY

CURRICULUM OF ITU FOOD ENGINEERING DEPARTMENT

Basic Science Courses: Calculus, Physics, Differential Equations, Statistics and Probability

Chemistry: General chemistry, Organic, chemistry, Analytical Chemistry and Instrumental Analysis

Engineering Courses: Intr. To Computer and Inf. Systems, Technical Drawing, Int. To Sci and Eng. Comp., Mass and Energy Balances, Thermodynamics, Fluid Mechanics, Heat Transfer, Mass Transfer, Process Control

1 SCOPE OF FOOD SCIENCE AND FOOD TECHNOLOGY

CURRICULUM OF ITU FOOD ENGINEERING DEPARTMENT

Food Engineering Courses: Intr. To food sc.&tech., Food Chemistry I and II, Microbiology, Food Microbiology I and II, Food Microbiology Laboratory, Food Engineering Unit Operations I and II, Food Engineering Laboratory, Food Engineering Design I And II, Food Technology, Food Technology Laboratory, Food Quality Control, Food Quality Control Laboratory, Graduation Study

Supplementary Courses: Turkish, English, History, Economics

1 SCOPE OF FOOD SCIENCE AND FOOD TECHNOLOGY

CURRICULUM OF ITU FOOD ENGINEERING DEPARTMENT

Elective Courses: Biochemistry, Physical Chemistry, Molecular Biology, Numerical Methods

Engineering Mechanics, Material Science, Principles of Electricity and Electronics

Statics and Strength, Total Quality Management,

Sensory Analysis, Food Packaging, Biotechnology, Cold Preservation Technologies, Rheological Measurements in Food Engineering, Shelf-life of Foods

1 SCOPE OF FOOD SCIENCE AND FOOD TECHNOLOGY

FOOD ENGINEERING EDUCATION AND CURRICULUM

Freshman

Sophomore

Juniors

Seniors

PROBLEMS RELATED WITH FOODS

Many diseases have a nutritional component and the lack of an adequate diet directly causes disease or contributes to an individual 's susceptibility to disease.

Problems in underdeveloped countries:

Most people are confronted with "malnutrition", including deficiency or lack of:

- Sufficient food (famine)
- Protein (- kwashiorkor) and sometimes both protein and calories (-marasmus): Mothers who do not receive sufficient protein or calories during pregnancy or during breast-feeding have children with increased susceptibility to disease.

PROBLEMS RELATED WITH FOODS

DEFICIENCY of SPECIFIC NUTRIENTS:

Iron deficiency: Results in both social and medical problems and less productivity.

Iodine deficiency disease: Causes goiterism thyroid enlargement and is still widespread. Eliminated by the addition of iodine to table salt.

Vitamin deficiencies: The major vitamin deficiency is for vitamin A. Leads to blindness and related diseases. Such deficiencies also lead to increased susceptibility to other diseases.

1 SCOPE OF FOOD SCIENCE AND FOOD TECHNOLOGY

PROBLEMS RELATED WITH FOODS

Problems in affluent countries:

- Obesity
- Diabetes
- CVD (cardiovascular diseases)

ACTIVITY OF FOOD SCIENTISTS

1. Many food scientists are engaged in developing palatable, nutritious, low-cost foods. (fish flour, dried milk, incaparina:a cereal formulation containing about 28% protein, prepared from a mixture of maize and cottonseed flour)
2. Work in industrial organizations for improvement of existing and development of new food products.
3. Alter the nutrient content of foods
   Reducing the caloric content (in soft drinks sucrose is replaced by aspartame, acesulfame K, etc. and in ice cream normal milk fat with specially treated proteins)
   Adding vitamins and minerals (breakfast cereals)

ACTIVITY OF FOOD SCIENTISTS

4. To make food as safe as possible (The correct application of food processing, storage and preservation methods prevent outbreaks of food processing)
5. Involved in establishing international food standards to promote and facilitate world trade and to assure the wholesomeness and value of foods purchased between nations.
6. Work in conjunction with nutritionists to develop standards for the optimal nutritional content of the diet and to determine how food processing and storage affects nutrients

TYPES OF FOOD PRODUCTS

Agricultural Commodities

Agro-Industry Products

ORGANIZATIONS OF SECTOR

- PRIVATE SECTOR

Factories and marketing firms

(Multinational and SME –Small and Medium Enterprises)

- PUBLIC SECTOR

Ministries of Agriculture,Ministries of Health, Ministries of Trade

State Enterprises (KİT)

Municipalities

Governmental Research Institutes (TUBITAK)

ORGANIZATIONS OF SECTOR

- SCIENTIFIC AND ACADEMIC INSTITUTIONS

Research Institutes

Universities

PROFESSIONALS IN THIS SECTOR

- Food Scientists:

(in universities and research organizations)
B.S. : Bachelor of Science
M.S. : Master of Science
Ph.D. : Doctor of Philosophy Degree

- Food Technologists + Engineers:

Engaged in production and processing of food commodities. Food engineer, Chemical engineer, Veterinerians, Agricultural engineer, Pharmacists

ORGANIZATIONS OF SECTOR

- Production technicians and workers:
- Bureaucrats (people working in Ministries)
- Sales personnel- engaged in trade

FUNCTIONAL DIVISIONS OF FIRMS

1. Management
2. Material acquisition department
3. Manufacturing departments
4. Quality control + assurance departments
5. Marketing department
6. Research + product development department

AUXILIARY INDUSTRIES

- Chemical Industries (Pfizer, Hoechst, Roche)- food additives- stabilizers, acidulants, preservatives, enzymes)
- Food ingredient (color/flavor) suppliers
- Packaging Industries (glass, plastics, tins, steel, aluminum companies, paper combiblocks)
- Food machinery & equipment manufacturers

CLASSIFICATION OF FOOD INDUSTRIES ACCORDING TO PRODUCT RANGE

1. Cereal Products
2. Milk and Dairy Products
3. Meat, Fish and Poultry Products
4. Fats and Oils
5. Confectionary Products
6. Fruits and Vegetable Products
7. Beverages
8. Catering

INNOVATIONS IN FOOD SCIENCE

- Feeding people under extraordinary conditions (combat rations, diet foods)
- Feeding populations exposed to famine
- Food analogues
  Meat analogues for vegetarians, Milk analogues, Egg analogues for cholesterol-free diets
- Floating fisheries
- Keyboard programming of production at factories
- New technologies for preservation (irradiation, lyophilization)
- Catering for community feeding

In TURKEY;

- 44% of population in active labor force is related with food production.
- 22.8% of Gross National Product (GNP) is from agricultural products
- Export value: 24%
- 9% of total exports earnings come from agro-industries (fruit juice, tomato paste, margarine)
- 15% of total export earnings come from agricultural raw materials (wheat, hazelnuts and apricots)
- Export value (food) > Import value (food)