

**American University of Beirut**  
**Faculty of Agricultural and Food Sciences**  
**Department of Nutrition and Food Science**

**NFSC 377 – Food Packaging**  
**Course Syllabus**  
**Fall 2010-2011**

**Course Instructor:**

Dr. Mohamad Abiad

**Prerequisites:**

NFSC 291 or equivalent

**Reference Text Books:**

- 1- Walter Soroka, Fundamentals of packaging technology, 2009. 4th ed. Institute of Packaging Professionals, USA
- 2- Robertson, G.L., Food Packaging: Principles and Practice, 2005. 2<sup>nd</sup> ed. CRC Press, London, UK.
- 3- Han, J.H., Innovation in Food Packaging, 2005. Elsevier Academic Press, London, UK
- 4- Lee, D.S., Yam, K.L., and Piergiovanni, L., Food Packaging Science and Technology, 2008. CRC Press, London, UK.
- 5- Coles, R., McDowell, D., and Kirwan, M.J., Food Packaging Technology, 2003. Blackwell Publishing Ltd., Oxford, UK.

**Course Description**

This course provides the students with the basic knowledge regarding food packaging materials, machinery and technology. It provides an overview of the elements of packaging science and engineering applied to the preservation, distribution and marketing of various food products. This course also explains the different procedures and food safety requirements for developing, evaluating and testing of food packages in accordance to international standards.

**Course Objectives**

The objectives of this course are to provide a fundamental understanding of the properties of packaging materials for use with food products, proper selection of packaging material for the stability and safety of food, as well as the manufacture of these materials and consequent packages.

## Learning Outcomes

Upon successful completion of this course the students will be able to:

<b>Outcomes</b>	<b>Teaching Strategy</b>	<b>Assessment Method &amp; Criteria for Evaluation</b>
1. Describe the main functions of food packaging	Class lecture	In class activities and problem solving
2. Identify and differentiate between primary, secondary and tertiary packaging	Class lecture	In class activities and problem solving
3. Identify the different technologies involved in packaging of food products and commodities	Class lecture and discussions including mini project	In class activities covering examples from industry
4. Describe and identify various packaging materials: paper and paperboard, metal cans and containers, glass, polymers and plastics, closures, adhesives, flexible packaging laminates, corrugated fiberboard, etc.	Class lecture	In class activities covering examples from industry
5. Describe the main testing procedures and requirements for testing packaging materials and packaged foods	Class lecture and discussions including mini project	In class activities and problem solving Examples from industry
6. Understand the effects of handling, shipping and transportation on various packages	Class lecture	In class activities covering examples from industry
7. Identify and discuss different packaging machineries	Class lecture and discussions including mini project	Presentation of project outcome and research about the unit operation and associated problems

8. Design packaging solutions	Class explanation discussion and mini project	Presentation of project outcome and research about the unit operation and associated problems
9. Evaluate the chemical, physical and mechanical properties of packages and packaging	Class lecture	In class activities and problem solving
10. Discuss the environmental issues pertaining to food packaging	Class explanation discussion and mini project	In class activities covering examples from industry

## Course Outline

- I. Packaging Functions
  - a. Introduction
  - b. Functions
  
- II. Paper and Paperboard
  - a. Source and preparation of fibers
  - b. Paper characterization
  - c. Paper types
  - d. Paperboard grades
  - e. Methods of paper characterization
  
- III. Paperboard Cartons
  - a. Package classification
  - b. Carton design
  - c. Selection of proper paperboard
  - d. Production process of paperboards
  
- IV. Metal Cans and Containers
  - a. Can-making steel
  - b. Three-piece steel cans
  - c. Two-piece drawn cans
  - d. Impact extrusion
  - e. Can dimensioning
  - f. Protective coating
  - g. Industrial metal containers
  - h. Aerosols
  
- V. Glass Containers
  - a. Glass types and properties
  - b. Glass manufacturing
  - c. Bottle design and manufacturing
  - d. Vials and ampoules
  - e. Carbonated beverages
  
- VI. Polymers and Plastics
  - a. Introduction to plastics
  - b. Polarity and material properties
  - c. Hydrocarbons, polyethylene and other packaging polymers
  - d. Thermoplastic and thermo-set polymers
  - e. Material selection and processing
    - i. Plasticating extrusion
    - ii. Profile extrusion

- iii. Extrusion blow molding
- iv. Injection blow molding
- v. Thermoforming
- vi. Other forming methods
- f. Plastic applications
  - i. Polyethylene (PE)
  - ii. Low-density and linear low-density polyethylene (LDPE and LLDPE)
  - iii. Polystyrene (PS)
  - iv. Polypropylene (PP)
  - v. Poly(ethylene terephthalate) (PET)
  - vi. Poly(vinyl chloride) (PVC)
  - vii. Poly(vinylidene chloride) (PVDC)
  - viii. Poly(vinyl acetate) and Ethylene-vinyl acetate (PVAC and EVA)
  - ix. Polyamide (PA or nylon)
  - x. Poly(vinyl alcohol) and Ethylene-vinyl alcohol (PVAL and EVAL)
  - xi. Other packaging polymers

## VII. Closures

- a. Container and closure dimensioning
- b. Metal closures
- c. Closure seals
- d. Plastic closures
- e. Closure application
- f. Tamper evidence
- g. Child-resistant closures
- h. Special closures and functions

## VIII. Adhesives

- a. Introduction to adhesives
- b. Theories of adhesion
- c. Surface treatment
- d. Solidification
- e. Adhesive application
- f. Adhesive selection and considerations
- g. Inspection of bond failures

## IX. Flexible packaging and laminates

- a. Laminates
- b. Aluminum foil
- c. Vacuum metalizing
- d. Silicone oxide coatings
- e. laminate structural and physical properties
- f. Flexible bags, pouches and sachets

- g. Sealability
- h. Barrier properties
- i. Examples of laminates

X. Corrugated Fiberboard

- a. Introduction
- b. Properties and tests
- c. Carrier rules and regulations
- d. Corrugated boxes
- e. Special board treatments and quality assurance

XI. Distribution packaging

XII. Package integrity testing

XIII. Packaging machinery

XIV. Applied packaging and package development