

COURSE SYLLABUS AND ASSESSMENT TOOLS

FST431 FOOD PACKAGING AND STORAGE TECHNOLOGY

Credit	: 2(2-0) (2 hours lectures and discussions per week for 14 weeks, no laboratory work)
Semester	: 7
Academic Year	: 2008/2009
Pre-requisite	: Food Chemistry (FST210), Food Microbiology (FST220), Principles of Food Processing (FST231).
Number of students	: 110
Delivery Method	: Lecture, class discussion, independent textbook reading, literature search and individual paper preparation
Course Coordinator	: Rizal Syarief
Contact	: 62-251-8626725; 0811110169
Lecturer	: 1. Rizal Syarief (rsyarief@ipb.ac.id,) 2. Yadi Haryadi (yadi_h@hotmail.com) 3. Nugraha Edhi Suyatma (nugrahaedhi@yahoo.com)
Day and Time	: Thursday, 08.00-09.40 a.m.
Classroom	: PAU lecture room 1 & 2

I. Course Description

This course covers types of food packaging material including metal, glass, paper, paperboard, and plastics, putting emphasis on their chemical and physical properties, their functional properties, interaction with foods and applications in selected food commodities. Different industrial filling systems and recent techniques in food packaging development are also covered. This course also discusses the function and the role of food storage and overview the factors causing food losses and deterioration. The basic food storage techniques, infestation control methods, and principle of food shelf life determination technique are also covered.

II. General Learning Objectives

By the end of this course, students are expected to have learned the role of packaging and storage technologies in preserving food materials from spoilage and deterioration and in extending their shelf life, compare different types of packaging materials, packaging techniques, storage techniques and infestation control methods. In relation to expected learning outcomes recommended in IFT education standard, students upon the completion of the course will be able to:

1. understand the major chemical reactions that limit shelf life of foods.
2. understand the role and significance of microbial inactivation, adaptation and environmental factors (i.e., water activity, pH, temperature) on growth and response of microorganisms in various environments.
3. identify the conditions, including sanitation practices, under which the important pathogens and spoilage microorganisms are commonly inactivated, killed or made harmless in foods.
4. know the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage.
5. understand the principles and current practices of processing techniques and the effects of processing parameters on product quality.
6. understand the properties and uses of various packaging materials.
7. improve student's success skills, especially in writing skills and information acquisition skills).

III. Specific Learning Objectives

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

1. describe the roles and functions of food packaging in a food processing system (C2, comprehension).
2. describe the properties and uses of flexible and semi rigid packaging materials, e.g. plastic, paper and aluminium foil (C2, comprehension).
3. describe the properties and uses of rigid packaging materials, e.g. metal and glass (C2, comprehension).
4. describe the interaction of food and packaging materials and the chemical migration from food packaging materials (C2, comprehension).
5. describe the concept of packaging design and compare different types of packaging design (C2-C4, comprehension-analysis).
6. compare novel food packaging technique and innovation in food packaging (C4, analysis).
7. use and evaluate the principles of Arrhenius method to predict the shelf life of food (C3-C6, application-evaluation).
8. describe the role and function of food storage and spoilage and deterioration mechanisms in foods and determine methods to control deterioration and spoilage (C2-C3, comprehension-application).
9. determine food losses occurred during the storage and evaluate the factors affecting the losses (C3-C6, application-analysis).
10. compare the different types of warehouse pest insects and their control (C4, analysis).
11. compare the different types of rodents as pest storage and their control (C4, analysis).
12. compare storage fungi and other spoilage microorganisms and their control (C4, analysis).
13. apply the principles of integrated pest management to control storage pests (C3, application).

14. use and select the appropriate method to store and preserve some foodstuffs (grains, fruits and vegetables) (C3-C6, application-evaluation).

IV. References and Lecture Notes

A. Major References/Textbooks

1. Robertson, G.L. 1993. Food Packaging - Principle and Practice. Marcel Dekker, New York.
2. Hanlon, J.F. 1984. Handbook of Package Engineering, McGraw Hill: New York.
3. Ahvenainen, R. 2003. Novel Food Packaging Technique. CRC Press, Cambridge.
4. Coles, R., McDowel, D. and Kirwan, M.J. 2003. Food Packaging Technology. Blackwell Publishing Ltd.
5. Rahman, M.S. 2007. Handbook of Food Preservation. CRC Press, Cambridge.
6. Hill, D.S. 2003. Pests of Stored Foodstuffs and their Control. Kluwer Academic Publishers, London.
7. Steele, R. (2004) Understanding and Measuring the Shelf-life of Food. Woodhead Publishing Limited, Cambridge, England.
8. Syarief, R., Santausa, S., and Halid, H. 1990. Teknologi Pengemasan Pangan. PAU IPB.
9. Multon, J.L. 1988. Preservation and Storage of Grains, Seeds, and Their By Products. Lavoisier Publishing, New York.
10. Sinha, R.N. and Muir, W.E., 1973. Grain Storage: Part of a System. The AVI Publishing Co., Inc., Wesport, Connecticut.

B. Lecture Notes

Lecture notes in the form of printed out power point presentation (available in Bahasa Indonesia and English) are available for each topic.

C. Other Sources

Teaching materials such as packaging materials, packaging models, photographs, charts, equipments, and videos will be presented as lecture materials.

V. Course Outline

Week	Topics	Sub-topics	Lecturers
1	The Function and the Role of Food Packaging	<ul style="list-style-type: none"> • History of food packaging • Function of packaging • The role of food packaging • The ergonomic and promotion through aesthetic packaging. 	RSY
2	Flexible and Semi Rigid Packaging Materials	<ul style="list-style-type: none"> • Plastics as food packaging material • Paper and paperboard as food packaging material • Aluminium foil as food packaging material • Comparison between flexible packaging materials 	RSY

Week	Topics	Sub-topics	Lecturers
		<ul style="list-style-type: none"> • The role and the application of flexible packaging 	
2	Rigid Packaging Materials	<ul style="list-style-type: none"> • Metals as food packaging material • Glass as food packaging material • Aluminium foil as food packaging material • Comparison between rigid packaging materials • The role and the application of rigid packaging 	RSY
4	Food Package Interaction and Chemical Migration from Packaging Material	<ul style="list-style-type: none"> • Introduction to food-package interaction and their compatibility • External and internal factors affecting food deterioration • Chemical migration from packaging into food: theory and food safety aspects • Regulation in food contact materials related with the use of food packaging materials 	RSY
5	Food Packaging Design	<ul style="list-style-type: none"> • Concept of food packaging design • Informative and communicative labelling design • The role of packaging design in supporting the marketing strategy. 	RSY
6	Recent Food Packaging Technique.	<ul style="list-style-type: none"> • Aseptic packaging • Modified and Controlled Atmosphere Packaging • Active and intelligent packaging • Edible and biodegradable packaging 	NES
7	Food Shelf-life Evaluation and Determination	<ul style="list-style-type: none"> • Theory of food shelf-life evaluation • Calculation of food shelf-life by using Accelerated Shelf-life Test (ASLT) with Arrhenius equation • Calculation of food shelf-life by using Accelerated Shelf-life Test (ASLT) with critical moisture content 	RSY
8	Function and Role of Food Storage	<ul style="list-style-type: none"> • Definition and history of food storage • Function and the role of storage 	YHA
9	Post Harvest Food Losses	<ul style="list-style-type: none"> • Quantitative losses during storage • Loss of quality • Food spoilage and deterioration factors. 	YHA
10	Storage Pest Insects	<ul style="list-style-type: none"> • Biology of insects • Classification and grouping insects according their family and damage caused 	YHA

Week	Topics	Sub-topics	Lecturers
		• Control of pest insects	
11	Storage Pest Rodents	• Biology of rodents: classification and grouping • Control of pest rodents	YHA
12	Food Spoilage by Microbiological Factors	• Types of spoilage microorganism and their caused damage • Types of mycotoxin • Control of pest microorganism	YHA
13	Infestation Control during Storage of Foods	• Introduction to integrated storage pest management • Store hygiene (sanitation) • Physical method of control • Biological control • Pesticides (chemical control) • Use of indigenous plant material (natural pest control)	YHA
14	Storage Techniques for Foodstuffs (Grains, Fruits and Vegetables)	• Types of foodstuffs • Good handling method and storing foodstuffs (grains, fruits and vegetables)	YHA

Note: RSY (Rizal Syarief); YHA (Yadi Haryadi); NES (Nugraha Edhi Suyatma)

VI. Potential Course Overlap

There will be some potential overlap topics with other courses, such as characteristic of fruits and vegetables: Characteristics of Food Materials (FST332) and Food Processing Technology (FST333).

VII. Lecture Rules

1. All cellular phones must be switched off during class periods. No exceptions.
2. Students arriving later than 15 minutes after the class has been started are not allowed to attend the lecture.
3. Make sure that you attend the class exceeding a minimum requirement. According to university rules, only students with a minimum of 80% class attendance are eligible to take a final written examination, except under extenuating circumstances.

VIII. Assessment Tools

A. Written Examinations

1. Midterm and final written examinations will be held during examination period scheduled by the Registrar's office.
2. The mid term and final examinations will cover course topics delivered in week 1-7 and 8-14, respectively.
3. Each written examination will be composed of 80-100 multiple-choice questions (A, B, C, D and E) of different types, and 2 essays at different cognitive levels. About

20% of questions are in English. Time allocation is 120 minutes and maximum score is 100.

4. Dishonesty or cheating during examination, such as obtaining or receiving illegal help or obtaining unauthorized information about an examination beforehand will result in failure of the course. Disciplinary action will be imposed if a student is found to have seriously violated any of the rules contained in the Code of Conduct: warning, reduction of grades, suspension or expulsion.
5. Answer keys and scores will be posted on the announcement board soon after exam papers are graded.
6. Here are some examples of different types of questions with different cognitive levels to make students familiar with written examination:

Example 1 (C1, knowledge)

Choose the most correct answer

Example of *Chitin Synthesis Inhibitor* is:

- (A) lindane
- (B) methyl Bromide
- (C) fenoxycarb
- (D) bufrofezin
- (E) All above answers are incorrect

Example 2 (C2, comprehension)

Choose:

- (A) If 1, 2, and 3 are correct
- (B) If 1 and 3 correct
- (C) If 2 and 4 correct
- (D) If 1, 2, 3, and 4 all are correct
- (E) If 1, 2, 3, and 4 all are incorrect

Plastic components suspected to be carcinogenic:

1. vinyl chloride
2. ethylene
3. di-butyl phthalate
4. polypropylene

Example 3 (C4, analysis)

The sentence is composed of a statement, the word because, and a reason which are written in sequence.

“During their life cycle, all storage insect pests experience complete metamorphose, because all storage insect pests experience their life cycle inside the grain kernel”.

Choose:

- (A) If the statement is correct, the reason is also correct, and there is relationship between them.
- (B) If the statement is correct, the reason is also correct, but there is no relationship between them
- (C) If the statement is correct and the reason is wrong

- (D) If the statement is wrong, and the reason is correct
- (E) If both the statement as well as the reason are wrong

Example 4 (C5, synthesis)

Which statement is incorrect?

- (A) LDPE, LLDPE, PP and HDPE are examples of polyolefins because they are straight-chain hydrocarbons composed only of carbon and hydrogen atoms
- (B) PS is a straight-chain hydrocarbon
- (C) PET is not an olefin because it contains oxygen
- (D) PS is not an olefin because it contains benzene rings
- (E) PVC and PVDC are not olefins because they contain chlorine

B. Quizzes

Quizzes will be given to provide the students feedback on their course performance. Quizzes (one essay question) will cover material from lectures and will be held during the course of the term for approximately 10 minutes. The quiz will cover a topic discussed in a previous lecture. A key will be given soon after the quiz completes.

C. Group Assignment: Writing Report Based on Discussion on a Case

1. The objective of a group assignment is to help students to make connections between a real case and the knowledge of packaging and storage of foods.
2. The class will be divided into groups consisting of 4 - 5 students per group. The member of each group will be chosen by the lecturer in random manner. For each assignment, the member of the group will not be the same.
3. Each group is required to search a case regarding packaging or storage practices observed obtained from any information source (newspaper, internet, magazine, direct observation in markets, etc). In case of limited cases from those sources, the lecturer will be ready with several cases to discuss.
4. After finding a case, each group discusses the case and writes a report. The report must contain the following information:
 - (1) *Title page*: Put a title of your report on the top of a new page, Name and ID of your group members, and name of course and code.
 - (2) *Description of the Case*: A short statement or paragraph stating the case that your group have selected and the objectives sought. Describe particular issues in the case that your group would like to discuss and elaborated.
 - (3) *Discussion and Literature Review*: Discuss the above issues and compare with the statements in the literatures.
 - (4) *Conclusion and Recommendations*: State your recommendations or conclusions to the case.
 - (5) *Cited References*: List all cited references in alphabetical order by following an official guidelines.
5. The report is graded based on the following criteria (maximum score for each criteria: 100): (1) writing technique including grammar and spelling (20%), (2) clarity and accuracy of case study description (20%), (3) quality of discussion and

the use of information from literature (30%); (4) conclusion and recommendation (20%), and (5) cited references (10%). Marked paper will be returned as a feedback.

The following rubric is used as a guideline to grade your paper.

Criteria	Excellent (90-100)	Strong case (80-89)	Developing (70-79)	Limited (60-69)
Description of the case (20%)	The case and objective of discussion are clearly described, and hypothetical problem solving is elaborated	The case is clearly describe and the objective of the discussion is clear	The case is describe clearly but no objective statement	The case is not describe clearly, no objective statement
Discussions and literature review (30%)	Excellent discussions of the case with support of relevant literatures	Discussions are relevant to the case and relevant literatures are cited	Discussions are relevant to the case but no literature cited	Discussions are not relevant; no literature is cited
Conclusion and Recommendation (20%)	Excellent conclusions and recommendations which are strongly related to the case	Good conclusions and recommendations which are related to the case	Conclusions and recommendations are not related to the case.	No conclusion/ recommendation
Cited references (10%)	Used many and varied references and all are presented in bibliography correctly	Use several references and all are presented in bibliography correctly	Very limited references but presented correctly in bibliography	No references cited
Writing technique (20%)	Excellent selection of words, construction of sentences and paragraph, resulting in excellent report	Good selection of words, construction of sentences and paragraph	Good selection of words, but poor construction of sentences and paragraph	Inappropriate selection of words; sentences and paragraph constructions are poor

IX. Course Grading

Assessment Tools	% of Grade	Maximum Score
One midterm written examination	30	100
One final written examination	30	100
Four quizzes	10	100
Four group assignments	30	100
Maximum Score		100

Final grade classification :

A ≥ 80; AB: 75-79; B: 70-74; BC: 65-69; C: 55-64; D: 45-54; E < 45

Assessment Tools to Measure the Achievement of Learning Outcomes in Food Packaging and Storage Technology Course (FST431)

Code : FST 431
 Course : Food Packaging and Storage Technology
 Credit : 2(2-0)

Code	Learning Outcomes	Topic Covered in this Course	Assessment Tools
I.B.2.	understand the major chemical reactions that limit shelf life of foods (cover in detail)	<ul style="list-style-type: none"> • Food spoilage and deterioration factors. • External and internal factors affecting food deterioration 	Written examination (midterm examination) and group assignment
II.C.1.	understand the role and significance of microbial inactivation, adaptation and environmental factors (i.e., A_w , pH, temperature) on growth and response of microorganisms in various environments (cover in detail)	<ul style="list-style-type: none"> • Types of spoilage microorganism and their caused damage • Types of mycotoxin • Control of microorganism 	Written examination (midterm and final examinations)
II.D.1	be able to identify the conditions, including sanitation practices, under which the important pathogens and spoilage microorganisms are commonly inactivated, killed or made harmless in foods (cover in some extent)	<ul style="list-style-type: none"> • Introduction to integrated storage pest management • Store hygiene (sanitation) • Food spoilage and deterioration factors • Control of microorganism 	Written examination (final examination) and quiz
III.B.1.	know the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage (cover in detail)	<ul style="list-style-type: none"> • Quantitative losses during storage • Qualitative losses during storage • Food spoilage and deterioration factors. • Control of pest microorganism • Types of spoilage microorganism and their caused damage 	Written examination (final examination) and quiz
III.B.2	Understand the principles that make a food product safe for consumption (cover in some extent)	<ul style="list-style-type: none"> • Introduction to integrated storage pest management • Store hygiene (sanitation) • Food spoilage and deterioration factors 	Written examination (final examination) and quiz

Code	Learning Outcomes	Topic Covered in this Course	Assessment Tools
		<ul style="list-style-type: none"> • Control of microorganism 	
III.D.1.	understand the principles and current practices of processing techniques and the effects of processing parameters on product quality (cover in some extent)	<ul style="list-style-type: none"> • Good handling method and storing foodstuffs (grains, fruits and vegetables) • Aseptic packaging • Modified and controlled atmosphere packaging • Active and intelligent packaging • Edible and biodegradable packaging 	Written examination (midterm and final examinations) and quiz
III.E.1.	understand the properties and uses of various packaging materials (cover in detail)	<ul style="list-style-type: none"> • Plastics as food packaging material • Paper and paperboard as food packaging material • Aluminum foil as food packaging material • Comparison between flexible packaging materials • The role and the application of flexible packaging • Metals (tin can and aluminium) as food packaging material • Glass as food packaging material • Comparison between rigid packaging materials • The role and the application of rigid packaging • Chemical migration from packaging into food: theory and food safety aspects • Regulation in food contact materials related with the use of food packaging materials • Concept of food packaging design • Informative and communicative labelling design • The role of packaging design in supporting the marketing strategy. • Aseptic packaging • Modified and Controlled 	Written examination (midterm examination), quiz, and group assignment.

Code	Learning Outcomes	Topic Covered in this Course	Assessment Tools
		Atmosphere Packaging <ul style="list-style-type: none"> • Active and intelligent packaging • Edible and biodegradable packaging • History of food packaging • Function of packaging 	
IV.D.1.	be able to apply the principles of food science to control and assure the quality of food products (cover in some extent)	<ul style="list-style-type: none"> • Function of packaging • The ergonomic and promotion through aesthetic packaging. • Aseptic packaging • Modified and Controlled Atmosphere Packaging • Active and intelligent packaging • Function and the role of storage • Calculation of food shelf-life by using Accelerated Shelf-life Test (ASLT) with Arrhenius equation • Calculation of food shelf-life by using Accelerated Shelf-life Test (ASLT) with critical moisture content 	Written examination (midterm and final examinations) and group assignment
VI.B.1	define a problem, identify potential causes and possible solutions, and make thoughtful recommendations (cover in detail)	Discussion and preparation of report of group assignment	Group assignment
VI.B.2	apply critical thinking skills to new situations (cover in detail)	Discussion and preparation of report of group assignment	Group assignment
VI.C.1	commit to the highest standards of professional integrity and ethical values (cover in detail)	Discussion and preparation of report of group assignment	Group assignment
VI.C.2	work and/or interact with individuals from diverse cultures (cover in detail)	Discussion and preparation of report of group assignment	Group assignment
VI.D.1	explain the skills necessary to continually educate one-self	Discussion and preparation of report of group assignment	Group assignment

Code	Learning Outcomes	Topic Covered in this Course	Assessment Tools
	(cover in some extent)		
VI.E.1	work effectively with others (cover in detail)	Discussion and preparation of report of group assignment	Group assignment
VI.F.1.	independently research scientific and non-scientific information (cover in some extent)	Discussion and preparation of report of group assignment	Group assignment
VI.G.2.	facilitate group projects (cover in detail)	Discussion and preparation of report of group assignment	Group assignment