

SUBJECT OUTLINE DETAILS

1. Subject: Food Biochemistry

- Code: CS344C
- Credits: 2
- Hours: 30 theory and exercise hours; 60 self-study hours

2. Management Unit:

- Department of Molecular Biotechnology
- Biotechnology Research and Development Institute

3. Prerequisites: Biochemistry I & II (BC461C & BC462C).

4. Subject objectives:

This course helps students understand the position of biotechnology in food biochemistry. It provides basic knowledge in food ingredients and chemical changes in food processing. This course also provides the practical information in food biochemistry which plays important roles in food science and technology.

4.1. Knowledge:

After completing this course, the students were expected to gain knowledge about:

- 4.1.1. The roles of water, carbohydrates, lipids, proteins, enzymes, food pigments and other substances in food processing.
- 4.1.2. Basic biochemistry process in food processing.
- 4.1.3. Practical information in food biochemistry and food processing.

4.2. Skills:

- 4.2.1. Students will be trained to have professional skills and competence to practice in food biochemical industry.
- 4.2.2. Students can design, implement, analyze and evaluate food biochemical experiments.
- 4.2.3. Students will be trained to get these skills: teamwork skills; scientific information search skills; synthesize, analyze and evaluate information skills; writing skills and presentation skills.

4.3. Attitude:

- 4.3.1. Students should understand the important role of food biochemistry in life science.
- 4.3.2. Students should be developed attitudes relevant to the application of food biochemical knowledge in practical.
- 4.3.3. Students must have a positively sense in their self-learning.

5. Brief description of subject content:

Food biochemistry is the course of biochemistry and its application to food biochemistry. This increase in knowledge has enriched our understanding of the molecular basis of living systems as well as biomaterials and has opened many new areas of applications in the fields of food science, technology, and nutrition. This course covers water, proteins, carbohydrates, lipids, enzymes, food pigments and their

relations to food. At the end of the course, students also study about biochemistry processes in food processing. Some food processing models will be described to help students get the advance knowledge for their practical in the laboratories and pilot plants. Furthermore, they will be able to use this knowledge for their job in the future.

6. Subject content structure:

	Content	Hours	Objectives
Chapter 1. Water	1.1. Fundamental Properties / Structure - Ice - Water 1.2. Availability in Foods - Water Activity - Isotherms 1.3. Water Activity/ Food Stability 1.4. Phase transition of Food Containing Water 1.5. Williams, Landel and Ferry equation (WLF)	2	4.2.1 4.2.2 4.2.3 4.3.1 4.3.2 4.3.3
Chapter 2. Proteins	2.1. Amino Acids / Basic Building Blocks 2.2. Peptides and Proteins - Primary Structure - Spatial Relations - Denaturation 2.3. 2.3 Functional Properties - Hydration / Solubility - Viscosity - Gelation / Texturization - Emulsification - Foaming 2.4. Nutritional Properties 2.5. Protein Modification / Processing and Storage 2.6. Maillard Browning 2.7. Biochemical changes of meat and fish	4	4.1.1 4.3.1 4.3.2 4.3.3
Chapter 3. Carbohydrates	3.1. Structure and Isomerism - Monosaccharides - Disaccharides and Oligosaccharides - Polysaccharides 3.2. Reactions of Carbohydrates - Hydrolysis - Acyclic Reactions - Dehydration / Thermal Degradation - Nonenzymatic Browning (Carmelization) 3.3. Functions of Monosaccharides and Oligosaccharides - Hydrophilicity - Flavor Ligands - Browning / Food Flavors - Sweetness	4	4.1.2 4.2.1 4.2.2 4.2.3 4.3.1 4.3.2 4.3.3

3.4.	Functions of Polysaccharides - Starch - Cellulose - Pentosans and Hemicellulose - Pectins - Gums (Alginates, Carrageenan, Locust bean gum, Xanthan Gum) 3.5. Biochemical changes during the postharvest of fruits and cereal		
Chapter 4.	Lipids 4.1. Fatty Acids 4.2. Glycerides 4.3. Physical Aspects - Triacylglycerol Distribution - Positional Distribution - Consistency - Emulsions/Emulsifiers 4.4. Chemical Aspects - Lipolysis - Autoxidation - Thermal Decomposition - Chemistry of Frying 4.5. Fat and Oil Processing - Hydrogenation - Interesterification 4.6. Role of Food Lipids - Physical Effects - Flavor Precursors - Nutritional Functions	4	4.1.2 4.2.1 4.2.2 4.2.3 4.3.1 4.3.2 4.3.3
Chapter 5.	Enzymes in Food 5.1. Specificity, Catalysis and Regulation 5.2. Factors Influencing Activity - Temperature and pH - Water Activity - Electrolytes / Ionic Strength 5.3. Endogenous Enzymes - Pectic Enzymes - Amylases - Cathepsins - Enzymatic Browning 5.4. Enzymes Added to Food / Processing 5.5. Stability of Dry Enzymes 5.6. Biotechnology and Enzymes	4	4.1.2 4.2.1 4.2.2 4.2.3 4.3.1 4.3.2 4.3.3

Chapter 6. Food Pigments	4	4.1.2
6.1. The Important Roles of Pigments in Food Processing		4.2.1
6.2. Chlorophyll		4.2.2
6.3. Carotenoid		4.2.3
6.4. Anthocyanin		4.3.1
6.5. Betalain		4.3.2
6.6. Red Pigments from Meat		4.3.3
6.7. Biochemical Changes with Pigments		
6.8. Biotechnology for Pigments		
Chapter 7. Biochemistry Processes in Food Processing	8	4.1.2
7.1. Beer Technology		4.2.1
7.2. Wine Technology		4.2.2
7.3. Milk and Dairy Products		4.2.3
7.4. Cereals and Cereal Products		4.3.1
7.5. Vegetable and Vegetable Products		4.3.2
7.6. Fruit and Fruit Products		4.3.3
7.7. Meat and Fish Products		

7. Teaching method:

- Teaching theories in class
- Group and individual home assignments
- Discussion in class
- Tests/ quizzes
- Final examination

8. Duties of student:

Students have to do the following duties:

- Attending at least 80 % hours of the course
- Participating in group and individual assignments
- Taking the tests/ quizzes
- Proactively implementing self-study
- Taking the final examination

9. Assessment of student learning outcomes:

9.1. Assessment

No.	Point components	Rules and Requirement	Weights	Objectives
1	Overall attendance	- Attend at least 80 % hours of the total hours in the classes	5%	4.3.2, 4.3.3
2	Group/individual assignments/ Discussion in class	- Report of the group/individual - Discuss in group or in class	10%	4.1, 4.2, 4.3.3
3	Tests/ quizzes	- Taking the quick tests/ quizzes	15%	4.1
5	Final examination	- Taking the final examination (90 minutes)	70%	4.1

9.2. Grading

- Grading components and final test scores will be marked on a scale of 10 (0 to 10), rounded to one decimal place.

- Subject score is the sum of all the components of the evaluation multiplied by the corresponding weight. The subject score is marked on a scale of 10 and rounded to one decimal place then is converted to A-B-C-D-F score and score on a scale of 4 under the academic provisions of Cantho University.

10. Materials:

Materials information	Code number
[1] Hand-out	Students are received hand-out in class
[2] Ballantine Books. 1977. The World guide to beer. New York : Ballantine Books.	641.2/ W927
[3] Belitz H.D., W. Grosch, P. Schieberle. 2004. Food chemistry. New York: Springer.	664.07/ B431
[4] Hui Y.H., Wai-Kit Nip ... [et al.]. 2006. Food biochemistry and Food processing Blackwell Pub. Professional.	664/ F686
[5] Joseph Alphonse Laker. 1975. Entrepreneurship and the development of the Japanese beer industry 1872-1937. U.S.A.: Indiana University.	338.4/ L192
[6] Kay Yockey Mehas, Sharon Leslay Rodgers. 1997. Food science: The biochemistry of Food and nutrition. New York: McGraw – hill.	664/ M486
[7] Richard Owusu-Apenten. 2004. Introduction to Food chemistry: CRC Press.	664.07/ O.97
[8] Srinivasan Damodaran, Kirk L. Parkin, Owen R. Fennema. 2008. Fennema's Food chemistry. CRC Press/Taylor & Francis.	664/ D163
[9] Steve W. Cuil. 2005. Food carbohydrates: chemistry, physical properties, and applications. CRC Press.	664/ F686

11. Self-study Guide:

Week	Content	Theory (hours)	Practice (hours)	Students' duties
1	Chapter 1. Water 1.1 Fundamental Properties / Structure - Ice - Water 1.2 Availability in Foods - Water Activity - Isotherms 1.3 Water Activity/ Food Stability 1.4 Phase transition of Food Containing Water 1.5 Williams, Landel and Ferry equation (WLF)	2	0	- Previous research and reference: +References/materials: Chapter 1, [1], [3], [4], [7] - Review the contents of the modules studied in class
2	Chapter 2. Proteins 2.1 Amino Acids / Basic	3	0	Previous research and reference: +References/materials: Chapter

	<p>Building Blocks</p> <p>2.2 Peptides and Proteins</p> <ul style="list-style-type: none"> - Primary Structure - Spatial Relations - Denaturation <p>2.3 Functional Properties</p> <ul style="list-style-type: none"> - Hydration / Solubility - Viscosity - Gelation/ Texturization - Emulsification - Foaming 			<p>2, [1], [3], [4], [6], [7]</p> <ul style="list-style-type: none"> - Review the contents of the modules studied in class
3	<p>2.4 Nutritional Properties</p> <p>2.5 Protein Modification / Processing and Storage</p> <p>2.6 Maillard Browning</p> <p>2.7 Biochemical changes of meat and fish</p>	3	0	<p>Previous research and reference: +References/materials: Chapter 2, [1], [3], [4], [6], [7]</p> <ul style="list-style-type: none"> - Review the contents of the modules studied in class - Make homework assignments
4	<p>Chapter 3. Carbohydrates</p> <p>3.1 Structure and Isomerism</p> <ul style="list-style-type: none"> - Monosaccharides - Disaccharides and Oligosaccharides - Polysaccharides <p>3.2 Reactions of Carbohydrates</p> <ul style="list-style-type: none"> - Hydrolysis - Acyclic Reactions - Dehydration / Thermal Degradation - Nonenzymatic Browning (Carmelization) <p>3.3. Functions of Monosaccharides and Oligosaccharides</p> <ul style="list-style-type: none"> - Hydrophilicity - Flavor Ligands - Browning / Food Flavors - Sweetness 	3	0	<p>Previous research and reference: +References/materials: Chapter 3, [1], [3], [4], [9]</p> <ul style="list-style-type: none"> - Review the contents of the modules studied in class - Tests/ quizzes
5	<p>3.4. Functions of Polysaccharides</p> <ul style="list-style-type: none"> - Starch - Cellulose - Pentosans and Hemicellulose - Pectins - Gums (Alginates, Carrageenan, Locust bean gum, Xanthan Gum) 	3	0	<p>Previous research and reference: +References/materials: Chapter 3, [1], [3], [4], [9]</p> <ul style="list-style-type: none"> - Review the contents of the modules studied in class - Make homework assignments

	3.5 Biochemical changes during the postharvest of fruits and cereal			
6	Chapter 4. Lipids 4.1 Fatty Acids 4.2 Glycerides 4.3 Physical Aspects - Triacylglycerol Distribution - Positional Distribution - Consistency - Emulsions/Emulsifiers	3	0	Previous research and reference: +References/materials: Chapter 4, [1], [3], [4], [6], [7] - Review the contents of the modules studied in class
7	4.4 Chemical Aspects - Lipolysis - Autoxidation - Thermal Decomposition - Chemistry of Frying 4.5 Fat and Oil Processing - Hydrogenation - Interesterification 4.6 Role of Food Lipids - Physical Effects - Flavor Precursors - Nutritional Functions	3	0	Previous research and reference: +References/materials: Chapter 4, [1], [3], [4], [6], [7] - Review the contents of the modules studied in class - Group exercise, discussion
8	Chapter 5. Enzymes in Food 5.1 Specificity, Catalysis and Regulation 5.2 Factors Influencing Activity - Temperature and pH - Water Activity - Electrolytes/ Ionic Strength 5.3 Endogenous Enzymes - Pectic Enzymes - Amylases - Cathepsins - Enzymatic Browning	5	0	Previous research and reference: +References/materials: Chapter 5, [1], [3], [4], [6] - Review the contents of the modules studied in class
9	5.4 Enzymes Added to Food/ Processing 5.5 Stability of Dry Enzymes 5.6 Biotechnology and Enzymes	5	0	Previous research and reference: +References/materials: Chapter 5, [1], [3], [4], [6] - Review the contents of the modules studied in class
10	Chapter 6. Food Pigments 6.1 The Important Roles of Pigments in Food Processing 6.2 Chlorophyll	5	0	+References/materials: Chapter 6, [1], [3], [4], [6] - Review the contents of the modules studied in class

	6.3 Carotenoid 6.4 Anthocyanin			- Group exercise, discussion
11	6.5 Betalain 6.6 Red Pigments from Meat 6.7 Biochemical Changes with Pigments 6.8 Biotechnology for Pigments	5	0	Previous research and reference: +References/materials: Chapter 6, [1], [3], [4], [6] - Review the contents of the modules studied in class - Tests/ quizzes
12	Chapter 7. Biochemistry Processes in Food Processing 7.1 Beer Technology 7.2 Wine Technology	5	0	Previous research and reference: +References/materials: Chapter 7, [1], [2], [4], [5], [8] - Review the contents of the modules studied in class
13	7.3 Milk and Dairy Products 7.4 Cereals and Cereal Products	5	0	Previous research and reference: +References/materials: Chapter 7, [1], [2], [4], [5], [8] - Review the contents of the modules studied in class - Group exercise, discussion
14	7.5 Vegetable and Vegetable Products 7.6 Fruit and Fruit Products	5	0	Previous research and reference: +References/materials: Chapter 7, [1], [2], [4], [5], [8] - Review the contents of the modules studied in class - Tests/ quizzes
15	7.7 Meat and Fish Products	5	0	Previous research and reference: +References/materials: Chapter 7, [1], [2], [4], [5], [8] - Submitted exercise group - Review the entire, final exam preparation

**ON BEHALF OF RECTOR
DEAN/ DIRECTOR**

Can Tho,/...../20...
HEAD OF DEPARTMENT