

SUBJECT OUTLINE DETAILS

1. Subject: Biochemistry I

- Code: BC461C
- Credits: 3
- Hours: 45 theory and exercise hours.

2. Management Unit:

- Department of Molecular Biotechnology
- Biotechnology Research and Development Institute

3. Prerequisites: Cells and Molecules I (BS110C), Organism and Populations (BS111C), Organic Chemistry I & II (CH251C & CH352C).

4. Subject objectives:

This course helps students understand history of the development of biochemical industry, the achievements and prospects of its development in many areas of life. It provides basic knowledge in biochemistry and the information of biochemical substances which plays important roles in living organism.

4.1. Knowledge:

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

- 4.1.1. The roles of water and chemical equilibrium play in organism.
- 4.1.2. Structure and function of biochemical substances such as: carbohydrate, lipids, amino acids, peptides, proteins, vitamins, enzymes and biological catalyst, nucleotides and nucleic acids.
- 4.1.3. Biological membranes and transport across membranes.

4.2. Skills:

- 4.2.1. Students will be trained to have professional skills and competence to practice in biochemical industry.
- 4.2.2. Students can design, implement, analyze and evaluate 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 biochemistry in life science.
- 4.3.2. Students should be developed attitudes relevant to the application of biochemical knowledge in practical such as biological processes, biomedical and biotechnology.
- 4.3.3. Students must have a positively sense in their self-learning.

5. Brief description of subject content:

Biochemistry I is the course of the chemical knowledge of living things. The course is an in-depth examination of the structure and function of biomolecules such as chemical and physical properties of carbohydrates, lipids, amino acids, peptides, proteins, vitamins, enzymes and biological catalyst, nucleotides and nucleic acids. Biological membranes and transport across membranes are also explained. These are the basic knowledge to help students clear understand about bioenergetics, biosynthesis and metabolism of carbohydrates, lipids, amino acids, proteins, nucleotides and related molecules which will be study in Biochemistry II. At the end of the course, students will understand how the chemical and physical properties of biological molecules influence their function. Furthermore, they will be able to use this knowledge to describe how chemical changes alter the function of biological systems.

6. Subject content structure:

	Content	Hours	Objectives
Chapter 1. Introduction to biochemistry 1.1. The general concept of biochemistry 1.2. History of biochemistry development 1.3. Fundamental knowledge for biochemistry study		3	4.2.1, 4.2.2, 4.2.3, 4.3.1, 4.3.2, 4.3.3
Chapter 2. Water, pH and ionic properties 2.1. Weak interactions in aqueous system 2.2. Ionization of water, weak acids and weak bases 2.3. Buffering against pH changes in biological system 2.4. Water as reactant 2.5. The fitness of the aqueous environment for living organisms		3	4.1.1, 4.3.1. 4.3.2, 4.3.3
Chapter 3. Amino acids, peptides and proteins 3.1. Introduction to amino acid and protein 3.2. Amino acids 3.3. Peptides and proteins 3.4. Protein structures 3.5. Protein functions 3.6. Protein classification 3.7. Protein extraction		9	4.1.2, 4.2.1, 4.2.2, 4.2.3, 4.3.1, 4.3.2, 4.3.3
Chapter 4. Carbohydrate and glycobiology 4.1. Introduction to carbohydrate 4.2. Monosaccharides 4.3. Disaccharides 4.4. Polysaccharides 4.5. Glycoconjugates: proteoglycans, glycoproteins, and glycolipids 4.6. Carbohydrates as informational molecules: the sugar code 4.7. Working with carbohydrates		9	4.1.2, 4.2.1, 4.2.2, 4.2.3, 4.3.1, 4.3.2, 4.3.3

Chapter 5. Lipids 5.1. Introduction to lipids 5.2. Storage lipids 5.3. Structural lipids in membranes 5.4. Lipids as signals, cofactors and pigments 5.5. Separation and analysis of lipids 5.6. Working with Lipids	6	4.1.2, 4.2.1, 4.2.2, 4.2.3, 4.3.1, 4.3.2, 4.3.3
Chapter 6. Nucleotides and nucleic acids 6.1. General introduction 6.2. Some Basics 6.3. Nucleic acid structure 6.4. Nucleic acid chemistry 6.5. Other function of nucleotides 6.6. Recombinant DNA	6	4.1.2, 4.2.1, 4.2.2, 4.2.3, 4.3.1, 4.3.2, 4.3.3
Chapter 7. Enzymes 7.1. An introduction to enzymes 7.2. Enzyme structure 7.3. How enzymes work 7.4. Vitamins and enzyme cofactors 7.5. Enzyme kinetics 7.6. Example enzymatic reactions 7.7. Regulatory enzymes 7.8. Enzyme classification	6	4.1.2, 4.2.1, 4.2.2, 4.2.3, 4.3.1, 4.3.2, 4.3.3
Chapter 8. Biological membranes and transport 8.1. The molecular constituents of membranes 8.2. Membrane dynamics 8.3. Solute transport across membranes	3	4.1.3, 4.2.1, 4.2.2, 4.2.3, 4.3.1, 4.3.2, 4.3.3

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
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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
4	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] Katherine J. Denniston, Joseph J. Topping, Robert L. Caret. 2001. General organic and biochemistry. Boston: McGraw-Hill.	547/ D411
[3] Geoffrey L. Zubay, William W. Parson and Dennis E. Vance. 1995. Principles of biochemistry Dubuque, Iowa: WCB.	572.3/ Z93
[4] Mary K. Campbell. 1999. Biochemistry. Orlando, Florida: Harcourt Brace.	572/ C189
[5] ERIC E CONN ... [et al.]. 1987. Outlines of biochemistry. Singapore: John Wiley and Sons.	572/ O.93
[6] Hames B. D. and Hooper N. M. 2000. Instant notes: Biochemistry. BIOS Scientific Publishers Limited.	Library of biochemistry lab, Personal Bookshelf

11. Self-study Guide:

Week	Content	Theory (hours)	Practice (hours)	Students' duties
1	Chapter 1. Introduction to biochemistry 1.1. The general concept of biochemistry 1.2. History of biochemistry development 1.3. Fundamental knowledge for biochemistry study	3	0	- Previous research and reference: +References/materials: Chapter 1, [1], [2] - Review the contents of the modules studied in class
2	Chapter 2. Water, pH and	3	0	Previous research and reference:

	ionic properties 2.1. Weak interactions in aqueous system 2.2. Ionization of water, weak acids and weak bases 2.3. Buffering against pH changes in biological system 2.4. Water as reactant 2.5. The fitness of the aqueous environment for living organisms			+References/materials: Chapter 2, [1], [3] - Review the contents of the modules studied in class
3	Chapter 3. Amino acids, peptides and proteins 3.1. Introduction to amino acid and protein 3.2. Amino acids	3	0	Previous research and reference: +References/materials: Chapter 3, [1], [2], [3], [4], [5], [6] - Review the contents of the modules studied in class - Make homework assignments
4	3.3. Peptides and proteins 3.4. Protein structures 3.5. Protein functions	3	0	Previous research and reference: +References/materials: Chapter 3, [1], [2], [3], [4], [5], [6] - Review the contents of the modules studied in class - Tests/ quizzes
5	3.5. Protein functions 3.6. Protein classification	3	0	Previous research and reference: +References/materials: Chapter 3, [1], [2], [3], [4], [5], [6] - Review the contents of the modules studied in class - Make homework assignments
6	Chapter 4. Carbohydrate and glycobiology 4.1. Introduction to carbohydrate 4.2. Monosaccharides 4.3. Disaccharides	3	0	Previous research and reference: +References/materials: Chapter 4, [1], [2], [3], [4], [6] - Review the contents of the modules studied in class
7	4.4. Polysaccharides 4.5. Glycoconjugates: Proteoglycans, glycoproteins and glycolipids	3	0	Previous research and reference: +References/materials: Chapter 4, [1], [2], [3], [4], [6] - Review the contents of the modules studied in class - Group exercise, discussion
8	4.6. Carbohydrates as informational molecules: the sugar code 4.7. Working with carbohydrates	3	0	Previous research and reference: +References/materials: Chapter 4, [1], [2], [3], [4], [6] - Review the contents of the modules studied in class
9	Chapter 5. Lipids	3	0	Previous research and reference:

	5.1. Introduction to lipids 5.2. Storage lipids 5.3. Structural lipids in membranes			+References/materials: Chapter 3, Chapter 5, [1], [2], [3], [5], [6] - Review the contents of the modules studied in class
10	5.4. Lipids as signals, cofactors and pigments 5.5. Separation and analysis of lipids 5.6. Working with lipids	3	0	+References/materials: Chapter 3, Chapter 5, [1], [2], [3], [5], [6] - Review the contents of the modules studied in class - Group exercise, discussion
11	Chapter 6. Nucleotides and nucleic acids 6.1. General introduction 6.2. Some basics 6.3. Nucleic acid structure	3	0	Previous research and reference: +References/materials: Chapter 6, [1], [2], [3], [5], [6] - Review the contents of the modules studied in class - Tests/ quizzes
12	6.4. Nucleic acid chemistry 6.5. Other function of nucleotides 6.6. Recombinant DNA	3	0	Previous research and reference: +References/materials: Chapter 6, [1], [2], [3], [5], [6] - Review the contents of the modules studied in class
13	Chapter 7. Enzymes 7.1. An introduction to enzymes 7.2. Enzyme structure 7.3. How enzymes work 7.4. Vitamins and enzyme cofactors	3	0	Previous research and reference: +References/materials: Chapter 7, [1], [2], [3], [5], [6] - Review the contents of the modules studied in class - Group exercise, discussion
14	7.5. Enzyme kinetics 7.6. Example enzymatic reactions 7.7. Regulatory enzymes 7.8. Enzyme classification	3	0	Previous research and reference: +References/materials: Chapter 7, [1], [2], [3], [5], [6] - Review the contents of the modules studied in class - Tests/ quizzes
15	Chapter 8. Biological membranes and transport 8.1. The molecular constituents of membranes 8.2. Membrane dynamics 8.3. Solute transport across membranes	3	0	Previous research and reference: +References/materials: Chapter 8, [1], [2], [3], [5], [6] - Submitted exercise group - Review the entire, final exam preparation

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**ON BEHALF OF RECTOR
DEAN/ DIRECTOR**

HEAD OF DEPARTMENT