MINISTRY OF EDUCATION AND TRAINING
CAN THO UNIVERSITY

SOCIALIST REPUBLIC OF VIETNAM
Independence - Freedom - Happiness

SUBJECT OUTLINE DETAILS

1. Subject: Organic Chemistry II

- Code: CH352C

- Credits: 3

- Hours: 45 hours

2. Management Unit:

- Department: Chemistry

- Faculty: The Colledge of Natural Sciences

3. Prerequisites: CH351C Organic Chemistry I (Hóa học Hữu cơ I)

4. Subject objectives:

4.1. Knowledge:

4.1.1. The chemistry of oxygen, nitrogen and sulfur-containing compounds: Alcohols and Phenols, Ethers and Epoxides, Thiols and Sulfides, Carboxylic Acid Derivatives, Amines and Heterocycles, Biomolecules, The Organic Chemistry of Metabolic Pathways, Orbitals and Organic Chemistry: Pericyclic Reactions, Synthetic Polymers. The content introduces their concept of structure, and reactivity, isomerism and stereochemistry, reaction mechanism and also their physical, chemical properties, nomenclature and preparations.

4.1.2. Use the modern spectroscopy methods: MS, NMR, UV-Vis, IR, …to determine the structures of organic compounds in different fields such as: chemistry, biology, food, drugs, environment,…

4.1.3. Understanding about effects of organic chemistry to social and environment.

4.2. Skill:

4.2.1. Hard skills

Understanding of important role of organic chemistry to country's development.

Use the modern spectroscopy methods: MS, NMR, UV-Vis, IR, …to analysis chemicals.

Suggest and build the research models in chemistry to support and solve the problems related to chemistry.

4.2.2. Soft skills

Help students find their way to the chemical and biology library easily and their ability to refer or, and generally does indepth reasearch into the topic they are interested in.

Enable working independently or in team and self-study in their life.

4.3. Attitude:

4.3.1. Construction students have a healthy and civilized lifestyle. To respect the law. Loyalty to the country always.

4.3.2. To have an inquiring mind, the will to work for progress**,**

4.3.3. Good team work, good attitude, cordial spirit, cooperation with colleagues in the work.

4.3.4. Strictly observe discipline and more dissemination on environmental issues, mobilization of citizen's contribution for and improvement of citizens' participation in environmental protection, increase the citizen's environmental awareness.

5. Brief description of subject content:

The chemistry of oxygen, nitrogen and sulfur-containing compounds: Alcohols and Phenols, Ethers and Epoxides, Thiols and Sulfides, Carboxylic Acid Derivatives, Amines and Heterocycles, Biomolecules, The Organic Chemistry of Metabolic Pathways, Orbitals and Organic Chemistry: Pericyclic Reactions, Synthetic Polymers. The content introduces their concept of structure, and reactivity, isomerism and stereochemistry, reaction mechanism and also their physical, chemical properties, nomenclature and preparations.

Use the modern spectroscopy methods: MS, NMR, UV-Vis, IR, …to determine the structures of organic compounds.

Understanding about effects of organic chemistry to social and environment.

6. Subject content structure:

6.1. Theory

	Content	Hours	Objectives
Chapter 1.	**Alcohols and Phenols**	**3**	4.1.1; 4.1.3; 4.2.
1.1.	Naming Alcohols and Phenols		
1.2.	Properties of Alcohols and Phenols		
1.3.	Preparation of Alcohols: A Review		
1.4.	Alcohols from Carbonyl Compounds: Reduction		
1.5.	Alcohols from Carbonyl Compounds: Grignard Reaction		
1.6.	Reactions of Alcohols		
1.7.	Oxidation of Alcohols		
1.8.	Protection of Alcohols		
1.9.	Phenols and Their Uses		
1.10.	Reactions of Phenols		
1.11.	Spectroscopy of Alcohols and Phenols		
Chapter 2.	**Ethers and Epoxides. Thiols and Sulfides**	3	4.1.1; 4.1.3; 4.2.
2.1.	Names and Properties of Ethers		
2.2.	Synthesis of Ethers		
2.3.	Reactions of Ethers: Acidic Cleavage		
2.4.	Reactions of Ethers: Claisen Rearrangement		
2.5.	Cyclic Ethers: Epoxides		
2.6.	Reactions of Epoxides: Ring-Opening		
2.7.	Crown Ethers		

	2.8. Thiols and Sulfides		
	2.9. Spectroscopy of Ethers		
Chapter 3.	**Aldehydes and Ketones: Nucleophilic Addition Reactions**	**3**	4.1.1; 4.1.3; 4.2.
	3.1. Naming Aldehydes and Ketones		
	3.2. Preparing Aldehydes and Ketones		
	3.3. Oxidation of Aldehydes and Ketones		
	3.4. Nucleophilic Addition Reactions of Aldehydes and Ketones		
	3.5. Nucleophilic Addition of H_2O: Hydration		
	3.6. Nucleophilic Addition of HCN: Cyanohydrin Formation		
	3.7. Nucleophilic Addition of Hydride and Grignard Reagents: Alcohol Formation		
	3.8. Nucleophilic Addition of Amines: Imine and Enamine Formation		
	3.9. Nucleophilic Addition of Hydrazine: The Wolff–Kishner Reaction		
	3.10. Nucleophilic Addition of Alcohols: Acetal Formation		
	3.11. Nucleophilic Addition of Phosphorus Ylides: The Wittig Reaction		
	3.12. Biological Reductions		
	3.13. Conjugate Nucleophilic Addition to α,β-Unsaturated Aldehydes and Ketones		
	3.14. Spectroscopy of Aldehydes and Ketones		
Chapter 4.	**Carboxylic Acids and Nitriles**	**3**	4.1.1; 4.1.3; 4.2.
	4.1. Naming Carboxylic Acids and Nitriles		
	4.2. Structure and Properties of Carboxylic Acids		
	4.3. Biological Acids and the Henderson–Hasselbalch Equation		
	4.4. Substituent Effects on Acidity		
	4.5. Preparing Carboxylic Acids		
	4.6. Reactions of Carboxylic Acids: An Overview		
	4.7. Chemistry of Nitriles		
	4.8. Spectroscopy of Carboxylic Acids and Nitriles		
Chapter 5.	**Carboxylic Acid Derivatives: Nucleoplilic Acyl Substitution Reactions**	3	4.1.1; 4.1.3; 4.2.
	5.1. Naming Carboxylic Acid Derivatives		
	5.2. Nucleophilic Acyl Substitution Reactions		
	5.3. Nucleophilic Acyl Substitution Reactions of Carboxylic Acids		
	5.4. Chemistry of Acid Halides		
	5.5. Chemistry of Acid Anhydrides		
	5.6. Chemistry of Esters		
	5.7. Chemistry of Amides		
	5.8. Chemistry of Thioesters and Acyl Phosphates: Biological Carboxylic Acid Derivatives		
	5.9. Polyamides and Polyesters: Step-Growth		

	Polymers		
5.10.	Spectroscopy of Carboxylic Acid Derivatives		
Chapter 6.	**Carbonyl Alpha-Substitution Reactions**	**3**	4.1.1; 4.1.3; 4.2.
6.1.	Keto–Enol Tautomerism		
6.2.	Reactivity of Enols: The Mechanism of Alpha-Substitution Reactions		
6.3.	Alpha Halogenation of Aldehydes and Ketones		
6.4.	Alpha Bromination of Carboxylic Acids		
6.5.	Acidity of Alpha Hydrogen Atoms: Enolate Ion Formation		
6.6.	Reactivity of Enolate Ions		
6.7.	Alkylation of Enolate Ions		
Chapter 7.	**Carbonyl Condensation Reactions**	**3**	4.1.1; 4.1.3; 4.2.
7.1.	Carbonyl Condensations: The Aldol Reaction		
7.2.	Carbonyl Condensations versus Alpha Substitutions		
7.3.	Dehydration of Aldol Products: Synthesis of Enones		
7.4.	Using Aldol Reactions in Synthesis		
7.5.	Mixed Aldol Reactions		
7.6.	Intramolecular Aldol Reactions		
7.7.	The Claisen Condensation Reaction		
7.8.	Mixed Claisen Condensations		
7.9.	Intramolecular Claisen Condensations: The Dieckmann Cyclization		
7.10.	Conjugate Carbonyl Additions: The Michael Reaction		
7.11.	Carbonyl Condensations with Enamines: The Stork Reaction		
7.12.	The Robinson Annulation Reaction		
7.13.	Some Biological Carbonyl Condensation Reactions		
Chapter 8.	**Amines and Heterocycles**	3	4.1.1; 4.1.3; 4.2.
8.1.	Amines		
8.2.	Structure and Properties of Amines		
8.3.	Basicity of Amines		
8.4.	Basicity of Arylamines		
8.5.	Biological Amines and the Henderson–Hasselbalch Equation		
8.6.	Synthesis of Amines		
8.7.	Reactions of Amines		
8.8.	Reactions of Arylamines		
8.9.	Heterocyclic Amines		
8.10.	Spectroscopy of Amines		
Chapter 9.	**Biomolecules: Carbohydrates**	**6**	4.1.1; 4.1.3; 4.2.
9.1.	Classification of Carbohydrates		

9.2.	Depicting Carbohydrate Stereochemistry: Fischer Projections		
9.3.	D,L Sugars		
9.4.	Configurations of Aldoses		
9.5.	Cyclic Structures of Monosaccharides: Anomers		
9.6.	Reactions of Monosaccharides		
9.7.	The Eight Essential Monosaccharides		
9.8.	Disaccharides		
9.9.	Polysaccharides and Their Synthesis		
9.10.	Other Important Carbohydrates		
9.11.	Cell-Surface Carbohydrates and Influenza Viruses		
Chapter 10.	**Biomolecules: Amino Acids, Peptides and Proteins**	**3**	4.1.1., 4.1.2. 4.1.3; 4.2.
10.1.	Structures of Amino Acids		
10.2.	Amino Acids and the Henderson–Hasselbalch Equation: Isoelectric Points		
10.3.	Synthesis of Amino Acids		
10.4.	Peptides and Proteins		
10.5.	Amino Acid Analysis of Peptides		
10.6.	Peptide Sequencing: The Edman Degradation		
10.7.	Peptide Synthesis		
10.8.	Automated Peptide Synthesis: The Merrifield Solid-Phase Method		
10.9	Protein Structure		
10.10	Enzymes and Coenzymes		
10.11	How Do Enzymes Work? Citrate Synthase		
Chapter 11.	**Biomolecules: Lipids**	**3**	4.1.1., 4.1.2. 4.1.3; 4.2.
11.1.	Waxes, Fats, and Oils		
11.2.	Soap		
11.3.	Phospholipids		
11.4.	Prostaglandins and Other Eicosanoids		
11.5.	Terpenoids		
11.6.	Steroids		
11.7.	Biosynthesis of Steroids		
Chapter 12.	**Biomolecules: Nucleic Acid**	**3**	4.1.1., 4.1.2. 4.1.3; 4.2.
12.1.	Nucleotides and Nucleic Acids		
12.2.	Base Pairing in DNA: The Watson–Crick Model		
12.3.	Replication of DNA		
12.4.	Transcription of DNA		
12.5.	Translation of RNA: Protein Biosynthesis		
12.6.	DNA Sequencing		
12.7.	DNA Synthesis		
12.8.	The Polymerase Chain Reaction		
Chapter 13.	**The Organic Chemistry of Metabolic Pathways**	**3**	4.1.1., 4.1.2. 4.1.3; 4.2.
13.1.	An Overview of Metabolism and Biochemical Energy		

13.2.	Catabolism of Triacylglycerols: The Fate of Glycerol		
13.3.	Catabolism of Triacylglycerols: β-Oxidation		
13.4.	Biosynthesis of Fatty Acids		
13.5.	Catabolism of Carbohydrates: Glycolysis Chemistry		
13.6.	Conversion of Pyruvate to Acetyl CoA		
13.7.	The Citric Acid Cycle		
13.8.	Carbohydrate Biosynthesis: Gluconeogenesis		
13.9.	Catabolism of Proteins: Deamination		
13.10.	Some Conclusions about Biological Chemistry		
Chapter 14.	**Orbitals and Organic Chemistry: Pericyclic Reactions**	**3**	4.1.1., 4.1.2. 4.1.3;
14.1.	Molecular Orbitals of Conjugated Pi Systems		
14.2.	Electrocyclic Reactions		
14.3.	Stereochemistry of Thermal Electrocyclic Reactions		
14.4.	Photochemical Electrocyclic Reactions		
14.5.	Cycloaddition Reactions		
14.6.	Stereochemistry of Cycloadditions		
14.7.	Sigmatropic Rearrangements		
14.8.	Some Examples of Sigmatropic Rearrangements		
14.9.	A Summary of Rules for Pericyclic Reactions		
Chapter 15.	**Synthetic Polymers**		
15.1.	Chain-Growth Polymers		
15.2.	Stereochemistry of Polymerization: Ziegler–Natta Catalysts		
15.3.	Copolymers		
15.4.	Step-Growth Polymers		
15.5.	Olefin Metathesis Polymerization		
15.6.	Polymer Structure and Physical Properties		

7. Teaching method:

- Traditional teaching styles combined with learning, solving excercises and teaching activities

- Learner roles involve in researching on the real problems, discussing in group, generating new ideas, promote their ability and their soft-skill as communication skill, presentation skill, computer skill, etc.

- Teacher roles active teaching methods make students attracted into learning activities actively based on the organization and instruction of lecturers.

- The role of instructional materials: use multimedia, computer-assisted teaching are an approach to teaching and learning in which computer technology is used as an aid to the presentation, reinforcement, lecturer design,…

8. Duties of student:

The essential duties of the students have to:

- present at least 80% theoretical hours
- finish the group and personal given exercises with accessing.
- take midterm exam
- take final exam
- organize and implemen self-study activities.

9. Assessment of student learning outcomes:

9.1. Assessment

Evaluating student's study following cumulative results of credits.

No.	Point components	Rules and Requirement	Weights	Objectives
1	Present	Present/absent hours	10%	4.3
2	Mark on solved exercises	Solved/given exercises	10%	4.2.1; 4.2.4; 4.3
3	Mark on solved exercises of group	- Report/represent/... - Contributed	5%	4.2.2; 4.2.5; 4.2.6; 4.3.
4	Mark on midterm exam	- Writing/multiple choice/ (30 min)	15%	4.1.1 to 4.1.4; 4.2.1
5	Mark on final exam	- Writing/multiple choice/ (60 min) - Present at least 80% theoretical hours - Compulsary to take exam	50%	4.1; 4.3; ...

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 score and score on a scale of 4 under the academic provisions of the University.

10. Materials:

Materials information	Code number

[1] **Organic chemistry** / John McMurry.- 6th ed..- Belmont, CA.: Brooks/Cole-Thomson Learning, 2004.- xxix, [1758 p.] ; ill. (some col.), 26 cm, 0534389996.- 547/ M168
Chi tiết
MFN: 116779

[2] **Organic chemistry** / Susan McMurry.- Australia: Thomson, 2004.- 868 p., 27 cm (Study guide and student solutions manual for John McMurry's), 0534409342.- 547/ M979
Chi tiết
MFN: 100852

[3] Schaum's outline of theory and problems of **organic chemistry** / Herbert Meislich, Haward Nechamkin, Jacob Sharefkin.- 3rd ed..- New York: McGraw-Hill, 1999.- 469 p., 27 cm (Schaum's outline series), 007134165X.- 547/ M499
Chi tiết
MFN: 65533

11. Self-study Guide:

Week	Content	Theory (hours)	Practice (hours)	Students' duties
1	**Chapter 1. Alcohols and Phenols** 1.1. Naming Alcohols and	3	0	- Student will study the theory carefully at home before going to the class with the Sections:

	Phenols 1.2. Properties of Alcohols and Phenols 1.3. Preparation of Alcohols: A Review 1.4. Alcohols from Carbonyl Compounds: Reduction 1.5. Alcohols from Carbonyl Compounds: Grignard Reaction 1.6. Reactions of Alcohols 1.7. Oxidation of Alcohols 1.8. Protection of Alcohols 1.9. Phenols and Their Uses 1.10. Reactions of Phenols 1.11. Spectroscopy of Alcohols and Phenols			- in the reference book 1 from 17.1 to 17.11, Chapter 17 - in the reference book 3 from page 256 to 277 and 430 to page 447. - Group (4-5 students) working: students have to solve the new excercises, 4-5 problems in Chapter 17 of the reference book 1
2	**Chapter 2. Ethers and Epoxides. Thiols and Sulfides** 2.1. Names and Properties of Ethers 2.2. Synthesis of Ethers 2.3. Reactions of Ethers: Acidic Cleavage 2.4. Reactions of Ethers: Claisen Rearrangement 2.5. Cyclic Ethers: Epoxides 2.6. Reactions of Epoxides: Ring-Opening 2.7. Crown Ethers 2.8. Thiols and Sulfides 2.9. Spectroscopy of Ethers	3	0	- Review the previous studied chapter of the reference book 1 - Student will study the theory carefully at home before going to the class with the Sections: - in the reference book 1 from 18.1 to 18.9, Chapter 18 - in the reference book 3 from page 208 to page 301. - Group (4-5 students) working: students have to solve the new excercises, 4-5 problems (18.1.-18.18.) in Chapter 18 of the reference book 1
3	**Chapter 3. Aldehydes and Ketones: Nucleophilic Addition Reactions** 3.1. Naming Aldehydes and Ketones 3.2. Preparing Aldehydes and Ketones 3.3. Oxidation of Aldehydes and Ketones 3.4. Nucleophilic Addition Reactions of Aldehydes and Ketones 3.5. Nucleophilic Addition	3	0	- Review the previous studied chapter of the reference book 1 - Student will study the theory carefully at home before going to the class with the Sections: - in the reference book 1 from 19.1 to 19.14, Chapter 19 - in the reference book 3 from page 302 to page 330. - Group (4-5 students) working: students have to solve the new excercises, 4-5 problems (19.1.-19.25) in Chapter 19 of the reference book 1

	of H_2O: Hydration 3.6. Nucleophilic Addition of HCN: Cyanohydrin Formation 3.7. Nucleophilic Addition of Hydride and Grignard Reagents: Alcohol Formation 3.8. Nucleophilic Addition of Amines: Imine and Enamine Formation 3.9. Nucleophilic Addition of Hydrazine: The Wolff–Kishner Reaction 3.10. Nucleophilic Addition of Alcohols: Acetal Formation 3.11. Nucleophilic Addition of Phosphorus Ylides: The Wittig Reaction 3.12. Biological Reductions 3.13. Conjugate Nucleophilic Addition to α,β-Unsaturated Aldehydes and Ketones 3.14. Spectroscopy of Aldehydes and Ketones			
4	**Chapter 4. Carboxylic Acids and Nitriles** 4.1. Naming Carboxylic Acids and Nitriles 4.2. Structure and Properties of Carboxylic Acids 4.3. Biological Acids and the Henderson–Hasselbalch Equation 4.4. Substituent Effects on Acidity 4.5. Preparing Carboxylic Acids 4.6. Reactions of Carboxylic Acids: An Overview 4.7. Chemistry of Nitriles 4.8. Spectroscopy of Carboxylic Acids and Nitriles	3	0	- Review the previous studied chapter of the reference book 1 - Student will study the theory carefully at home before going to the class with the Sections: - in the reference book 1 from 20.1 to 20.8, Chapter 20 - in the reference book 3 from page 331 to page 372. - Group (4-5 students) working: students have to solve the new excercises, 4-5 problems (20.1.-20.15) in Chapter 20 of the reference book 1
5	**Chapter 5. Carboxylic**	3		- Review the previous studied chapter of the reference book 1

	Acid Derivatives: Nucleoplilic Acyl Substitution Reactions 5.1. Naming Carboxylic Acid Derivatives 5.2. Nucleophilic Acyl Substitution Reactions 5.3. Nucleophilic Acyl Substitution Reactions of Carboxylic Acids 5.4. Chemistry of Acid Halides 5.5. Chemistry of Acid Anhydrides 5.6. Chemistry of Esters 5.7. Chemistry of Amides 5.8. Chemistry of Thioesters and Acyl Phosphates: Biological Carboxylic Acid Derivatives 5.9. Polyamides and Polyesters: Step-Growth Polymers 5.10. Spectroscopy of Carboxylic Acid Derivatives			- Student will study the theory carefully at home before going to the class with the Sections: - in the reference book 1 from 21.1 to 21.10, Chapter 21 - in the reference book 3 from page 331 to page 372. - Group (4-5 students) working: students have to solve the new excercises, 4-5 problems (21.1- 21.26) in Chapter 21 of the reference book 1
6	**Chapter 6. Carbonyl Alpha-Substitution Reactions** 6.1. Keto–Enol Tautomerism 6.2. Reactivity of Enols: The Mechanism of Alpha-Substitution Reactions 6.3. Alpha Halogenation of Aldehydes and Ketones 6.4. Alpha Bromination of Carboxylic Acids 6.5. Acidity of Alpha Hydrogen Atoms: Enolate Ion Formation 6.6. Reactivity of Enolate Ions 6.7. Alkylation of Enolate Ions	3	0	- Review the previous studied chapter of the reference book 1 - Student will study the theory carefully at home before going to the class with the Sections: - in the reference book 1 from 22.1 to 22.7, Chapter 22 - in the reference book 3 from page 331 to page 372. - Group (4-5 students) working: students have to solve the new excercises, 4-5 problems (22.1-22.16) in Chapter 22 of the reference book 1
7	**Chapter 7. Carbonyl Condensation Reactions** 7.1. Carbonyl Condensations: The Aldol Reaction 7.2. Carbonyl	3	0	- Review the previous studied chapter of the reference book 1 - Student will study the theory carefully at home before going to the class with the Sections: - in the reference book 1 from 23.1 to

	Condensations versus Alpha Substitutions 7.3. Dehydration of Aldol Products: Synthesis of Enones 7.4. Using Aldol Reactions in Synthesis 7.5. Mixed Aldol Reactions 7.6. Intramolecular Aldol Reactions 7.7. The Claisen Condensation Reaction 7.8. Mixed Claisen Condensations 7.9. Intramolecular Claisen Condensations: The Dieckmann Cyclization 7.10. Conjugate Carbonyl Additions: The Michael Reaction 7.11. Carbonyl Condensations with Enamines: The Stork Reaction 7.12. The Robinson Annulation Reaction 7.13. Some Biological Carbonyl Condensation Reactions			23.13, Chapter 23 - in the reference book 3 from page 373 to page 399. - Group (4-5 students) working: students have to solve the new excercises, 4-5 problems (23.1-23.22) in Chapter 23 of the reference book 1
8	**Chapter 8. Amines and Heterocycles** 8.1. Amines 8.2. Structure and Properties of Amines 8.3. Basicity of Amines 8.4. Basicity of Arylamines 8.5. Biological Amines and the Henderson–Hasselbalch Equation 8.6. Synthesis of Amines 8.7. Reactions of Amines 8.8. Reactions of Arylamines 8.9. Heterocyclic Amines 8.10. Spectroscopy of Amines	3	0	- Review the previous studied chapter of the reference book 1 - Student will study the theory carefully at home before going to the class with the Sections: - in the reference book 1 from 24.1 to 24.10, Chapter 24 - in the reference book 3 from page 400 to page 429 and from page 448 to page 463. - Group (4-5 students) working: students have to solve the new excercises, 4-5 problems (24.1-24.25) in Chapter 24 of the reference book 1
9	**Chapter 9. Biomolecules: Carbohydrates** 9.1. Classification of	6	0	- Review the previous studied chapter of the reference book 1 - Student will study the theory carefully at home before going to the class with

	Carbohydrates 9.2. Depicting Carbohydrate Stereochemistry: Fischer Projections 9.3. D,L Sugars 9.4. Configurations of Aldoses 9.5. Cyclic Structures of Monosaccharides: Anomers 9.6. Reactions of Monosaccharides 9.7. The Eight Essential Monosaccharides 9.8. Disaccharides 9.9. Polysaccharides and Their Synthesis 9.10. Other Important Carbohydrates 9.11. Cell-Surface Carbohydrates and Influenza Viruses			the Sections: - in the reference book 1 from 25.1 to 25.11, Chapter 25 - Group (4-5 students) working: students have to solve the new excercises, 4-5 problems (25.1-25.25) in Chapter 25 of the reference book 1
10	**Chapter 10. Biomolecules: Amino Acids, Peptides and Proteins** 10.1. Structures of Amino Acids 10.2. Amino Acids and the Henderson–Hasselbalch Equation: Isoelectric Points 10.3. Synthesis of Amino Acids 10.4. Peptides and Proteins 10.5. Amino Acid Analysis of Peptides 10.6. Peptide Sequencing: The Edman Degradation 10.7. Peptide Synthesis 10.8. Automated Peptide Synthesis: The Merrifield Solid-Phase Method 10.9. Protein Structure 10.10. Enzymes and Coenzymes 10.11 How Do Enzymes Work? Citrate Synthase	3		- Review the previous studied chapter of the reference book 1 - Student will study the theory carefully at home before going to the class with the Sections: - in the reference book 1 from 26.1 to 26.11, Chapter 26 - Group (4-5 students) working: students have to solve the new excercises, 4-5 problems (26.1-26.18) in Chapter 26 of the reference book 1
11	**Chapter 11. Biomolecules: Lipids**	3	0	- Review the previous studied chapter of the reference book 1

	11.1. Waxes, Fats, and Oils 11.2. Soap 11.3. Phospholipids 11.4. Prostaglandins and Other Eicosanoids 11.5. Terpenoids 11.6. Steroids 11.7. Biosynthesis of Steroids			- Student will study the theory carefully at home before going to the class with the Sections: - in the reference book 1 from 27.1 to 27.7, Chapter 27 - Group (4-5 students) working: students have to solve the new excercises, 4-5 problems (27.1-27.10) in Chapter 27 of the reference book 1
12	**Chapter 12. Biomolecules: Nucleic Acid** 12.1. Nucleotides and Nucleic Acids 12.2. Base Pairing in DNA: The Watson–Crick Model 12.3. Replication of DNA 12.4. Transcription of DNA 12.5. Translation of RNA: Protein Biosynthesis 12.6. DNA Sequencing 12.7. DNA Synthesis 12.8. The Polymerase Chain Reaction	3	0	- Review the previous studied chapter of the reference book 1 - Student will study the theory carefully at home before going to the class with the Sections: - in the reference book 1 from 28.1 to 28.8, Chapter 28 - Group (4-5 students) working: students have to solve the new excercises, 4-5 problems (28.1-28.12) in Chapter 28 of the reference book 1
13	**Chapter 13. The Organic Chemistry of Metabolic Pathways** 13.1. An Overview of Metabolism and Biochemical Energy 13.2. Catabolism of Triacylglycerols: The Fate of Glycerol 13.3. Catabolism of Triacylglycerols: β-Oxidation 13.4. Biosynthesis of Fatty Acids 13.5. Catabolism of Carbohydrates: Glycolysis Chemistry 13.6. Conversion of Pyruvate to Acetyl CoA 13.7. The Citric Acid Cycle 13.8. Carbohydrate Biosynthesis: Gluconeogenesis	3	0	- Review the previous studied chapter of the reference book 1 - Student will study the theory carefully at home before going to the class with the Sections: - in the reference book 1 from 29.1 to 29.10, Chapter 29 - Group (4-5 students) working: students have to solve the new excercises, 4-5 problems (29.1-29.16) in Chapter 29 of the reference book 1

	13.9. Catabolism of Proteins: Deamination 13.10. Some Conclusions about Biological Chemistry			
14	**Chapter 14. Orbitals and Organic Chemistry: Pericyclic Reactions** 14.1. Molecular Orbitals of Conjugated Pi Systems 14.2. Electrocyclic Reactions 14.3. Stereochemistry of Thermal Electrocyclic Reactions 14.4. Photochemical Electrocyclic Reactions 14.5. Cycloaddition Reactions 14.6. Stereochemistry of Cycloadditions 14.7. Sigmatropic Rearrangements 14.8. Some Examples of Sigmatropic Rearrangements 14.9. A Summary of Rules for Pericyclic Reactions	3	0.	- Review the previous studied chapter of the reference book 1 - Student will study the theory carefully at home before going to the class with the Sections: - in the reference book 1 from 30.1 to 30.9, Chapter 30 - Group (4-5 students) working: students have to solve the new excercises, 4-5 problems (30.1-30.10) in Chapter 30 of the reference book 1
15	**Chapter 15 Synthetic Polymers** 15.1. Chain-Growth Polymers 15.2. Stereochemistry of Polymerization: Ziegler–Natta Catalysts 15.3. Copolymers 15.4. Step-Growth Polymers 15.5. Olefin Metathesis Polymerization 15.6. Polymer Structure and Physical Properties			- Review the previous studied chapter of the reference book 1 - Student will study the theory carefully at home before going to the class with the Sections: - in the reference book 1 from 31.1 to 31.6, Chapter 31 - Group (4-5 students) working: students have to solve the new excercises, 4-5 problems (31.1-31.12) in Chapter 31 of the reference book 1

Can Tho, ……./……../20…

ON BEHALF OF RECTOR
DEAN/ DIRECTOR

HEAD OF DEPARTMENT