



COURSE SYLLABUS

DEPARTMENT: **CHEMISTRY DEPARTMENT**
 COURSE CODE: **CHEM 140b**
 COURSE TITLE: **BIOCHEMISTRY (for Nursing majors)**
 CREDIT UNITS: 5.0 units (54 hours lecture & 108 hours laboratory)
 PRE-REQUISITE: CHEM 110
 SCHEDULE: _____
 INSTRUCTOR: _____
 CONSULTATION TIME: _____

COURSE DESCRIPTION: Biochemistry deals with the study of chemical processes in living organisms. It explains the complexity of life by providing knowledge on the structure and functions of the biological molecules that include lipids, carbohydrates, proteins, nucleic acids, and other intercellular and extracellular components. This course also covers the digestion and metabolism of these biomolecules, neurotransmitters, gene expression and protein synthesis. Course activities such as problem solving and laboratory experiments are designed to help develop analytical and critical thinking skills. This course will equip health-related programs with proper and sufficient knowledge to better understand the nature of physiological conditions.

EXPECTED LASALLIAN GRADUATE ATTRIBUTES (ELGA)	LEARNING OUTCOMES BASED ON ELGA At the end of this course, the students shall manifest the ELGA by:
GOD-LOVING Spirit of Faith	<ul style="list-style-type: none"> ○ imparting to the public and making them realize the amazing works of God in our world and society through chemistry and ○ demonstrating the love of God by showing to the public how chemistry can change and improve the lives of people in our society.
PATRIOTIC PROFESSIONALS Zeal for Service	<ul style="list-style-type: none"> ○ developing ways on how to increase the awareness of the public to the common health and environmental problems in our country through chemistry and ○ developing means on how to address the common health and environmental problems in the society through chemistry.
PERSON-ORIENTED Communion in Mission & Reverence for Life	<ul style="list-style-type: none"> ○ extending help to the community by increasing the awareness of the public to the common health and environmental problems in the society or in the community through chemistry.

LEARNING OUTCOMES

- LO 1. Higher levels of comprehension
- LO 2. Proficient and effective communication
- LO 3. Understanding of basic concepts across the domains of knowledge
- LO 4. Critical, analytical, and creative thinking
- LO 5. Application of different analytical modes in tackling problems methodically
- LO 6. Ability to contribute personally and meaningfully to the country's development
- LO 7. Capacity to reflect critically on shared concerns and think of innovative, creative solutions guided by ethical standards
- LO 8. Working effectively in a group
- LO 9. Problem-solving
- LO 10. Basic work-related skills and knowledge

PRELIMINARY PERIOD LEARNING PLAN

COURSE OUTLINE

LEARNING OUTCOMES At the end of each topic, the students should be able to:	TOPICS	LEARNING ACTIVITIES/ TEACHING STRATEGIES	ASSESSMENT
<ul style="list-style-type: none">• identify a functional group;• distinguish the structures of the common classes of organic compounds from one another;• draw the structure or give the name of an organic compound following the rules of IUPAC;• describe the physical properties of each class of organic compounds based on the intermolecular forces of attraction;• predict the physical properties of an organic compound based on structure; and• compare and contrast the physical properties of the classes of organic compounds among each other.	1. Structure and Physical Properties of Organic Compounds <ol style="list-style-type: none">1. Alkanes2. Alkenes and Alkynes3. Benzene and Its Derivatives4. Alcohols, Ethers, and Thiols5. Amines6. Aldehydes and Ketones7. Carboxylic Acids8. Carboxylic Acid Derivatives	<ul style="list-style-type: none">• Lecture Discussion• Video Presentation• Group Discussion	<ul style="list-style-type: none">• Formal Examinations• Recitations• Board Work• Seat Work• Problem Set
<ul style="list-style-type: none">• identify the common reactions in organic chemistry;• predict the major product of an organic chemical reaction;• propose a reasonable synthesis of an organic compound;• group organic compounds based on reactivity;• identify the common organic reactions that happen in biological systems;• describe chirality in organic molecules;• enumerate some importance of chirality in organic molecules; and	2. Basic Reactions of Organic Compounds <ol style="list-style-type: none">1. Alkanes2. Alkenes and Alkynes3. Benzene and Its Derivatives4. Alcohols, Ethers, and Thiols5. Amines6. Aldehydes and Ketones7. Carboxylic Acids8. Carboxylic Acid Derivatives	<ul style="list-style-type: none">• Lecture Discussion• Video Presentation• Group Discussion	<ul style="list-style-type: none">• Formal Examinations• Recitations• Board Work• Seat Work• Problem Set

<ul style="list-style-type: none"> perform basic organic chemistry laboratory techniques. 			
<ul style="list-style-type: none"> define monosaccharides; draw structures of monosaccharides using Fischer projections and Haworth projections; explain the reactions of monosaccharides; draw disaccharides and Glycosidic bonds; distinguish a monosaccharide from a disaccharide, and from an oligosaccharide; define polysaccharides; describe acidic polysaccharides; and distinguish the classes of monosaccharides based on chemical reactions. 	3. Carbohydrates <ol style="list-style-type: none"> Monosaccharides Cyclic Structures of Monosaccharides Characteristic Reactions of Monosaccharides Disaccharides and Oligosaccharides Polysaccharides Acidic Polysaccharides 	<ul style="list-style-type: none"> Lecture Discussion Video Presentation Group Discussion 	<ul style="list-style-type: none"> Formal Examinations Recitations Board Work Seat Work Problem Set
<ul style="list-style-type: none"> define lipids; draw the structures of triglycerides; describe the properties of triglycerides; identify and draw the structures of complex lipids; explain the role of lipids in biological membranes; discuss the roles and importance of glycerophospholipids, sphingolipids, glycolipids, and steroids; discuss the roles of steroid hormones; discuss the roles of bile salts; and explain the functions of the eicosanoids. 	4. Lipids <ol style="list-style-type: none"> Introduction to Lipids Structures of Triglycerides Some Properties of Triglycerides Structures of Complex Lipids The Role of Lipids in the Structure of Membranes Glycerophospholipids Sphingolipids Glycolipids Steroids Some Physiological Roles of Steroid Hormones Bile Salts Prostaglandins, Thromboxanes, and Leukotrienes 	<ul style="list-style-type: none"> Lecture Discussion Video Presentation Group Discussion 	<ul style="list-style-type: none"> Formal Examinations Recitations Board Work Seat Work Problem Set
<ul style="list-style-type: none"> enumerate the functions of proteins; define amino acids; describe the properties of amino acids; define a zwitterion; identify the uncommon amino acids; describe and illustrate the formation of peptide bonds; describe the properties of proteins; explain the levels of proteins structure; and discuss protein denaturation and its role. 	5. Proteins <ol style="list-style-type: none"> Functions of Proteins Amino Acids Zwitterions Characteristics of Amino Acids Uncommon Amino Acids Formation of Peptide Bonds and Formation of Proteins Properties of Proteins 	<ul style="list-style-type: none"> Lecture Discussion Video Presentation Group Discussion 	<ul style="list-style-type: none"> Formal Examinations Recitations Board Work Seat Work Problem Set

	8. Primary Structure of a Protein 9. Secondary Structure of a Protein 10. Tertiary Structure of a Protein 11. Quaternary Structure of a Protein 12. Protein Denaturation		
PRELIMINARY PERIOD ASSESSMENT			

MIDTERM PERIOD LEARNING PLAN

LEARNING OUTCOMES At the end of each topic, the students should be able to:	TOPICS	LEARNING ACTIVITIES/ TEACHING STRATEGIES	ASSESSMENT
<ul style="list-style-type: none"> • define enzymes; • identify the different classes of enzymes; • define enzyme terminologies; • explain the factors that influence enzymatic activity; • explain the mechanism of enzyme action and cite examples; • discuss enzyme regulation; • discuss the use of enzymes in medicine; and • explain the transition-state analogs and designer enzymes. 	6. Enzymes <ol style="list-style-type: none"> 1. Introduction to Enzymes 2. Naming and Classifying Enzymes 3. Enzyme Terminologies 4. Factors that Influence Enzyme Activity 5. Mechanisms of Enzyme Action 6. Enzyme Regulation 7. Enzymes Used in Medicine 8. Transition-State Analogs and Designer Enzymes 	<ul style="list-style-type: none"> • Lecture Discussion • Video Presentation • Group Discussion 	<ul style="list-style-type: none"> • Formal Examinations • Recitations • Board Work • Seat Work • Problem Set
<ul style="list-style-type: none"> • identify the molecules involved in chemical communications; • explain the physiological roles and significance of chemical messengers; • discuss the cell and its organelles; and • compare a prokaryotic cell and a eukaryotic cell. 	7. Neurotransmitters and Hormones <ol style="list-style-type: none"> 1. Molecules involved in Chemical Communications 2. Chemical Messengers Classified as Neurotransmitters and Hormones 3. Acetylcholine as a Messenger 4. Amino Acids as Neurotransmitters 5. Adrenergic Messengers 6. Role of Peptides in Chemical Communication 7. Steroid Hormones as Messengers 	<ul style="list-style-type: none"> • Lecture Discussion • Video Presentation • Group Discussion 	<ul style="list-style-type: none"> • Formal Examinations • Recitations • Board Work • Seat Work • Problem Set
<ul style="list-style-type: none"> • 	8. Nucleotides, Nucleic Acids, and Heredity <ol style="list-style-type: none"> 1. Molecules of Heredity 2. Composition of Nucleic Acids 3. Structures of DNA and RNA 4. Different Classes of RNA 	<ul style="list-style-type: none"> • Lecture Discussion • Video Presentation • Group Discussion 	<ul style="list-style-type: none"> • Formal Examinations • Recitations • Board Work • Seat Work • Problem Set

	<ol style="list-style-type: none"> 5. Genes 6. DNA Replication 7. DNA Repair 8. DNA Amplification 		
<ul style="list-style-type: none"> • define the central dogma of molecular biology; • explain the process of transcription; • explain the role of RNA in translation; • define the Genetic Code; • explain the process of protein synthesis at the molecular level; • discuss gene regulation and its importance; • define mutation, discuss its process and role; • identify different types of mutations; • explain the importance of DNA manipulation; and • discuss gene therapy and its role in medicine. 	9. Gene Expression and Protein Synthesis <ol style="list-style-type: none"> 1. The Central Dogma of Molecular Biology 2. Transcription 3. RNA and Translation 4. The Genetic Code 5. Protein Synthesis 6. Gene Regulation 7. Mutations 8. DNA Manipulation 9. Gene Therapy 	<ul style="list-style-type: none"> • Lecture Discussion • Video Presentation • Group Discussion 	<ul style="list-style-type: none"> • Formal Examinations • Recitations • Board Work • Seat Work • Problem Set
<ul style="list-style-type: none"> • define metabolism and differentiate catabolism from anabolism; • explain the role of the mitochondrion in metabolism; • identify the principal compounds involved in the common metabolic pathway; • discuss the citric acid cycle and its significance; • discuss the electron and proton transport and their physiological roles; • explain the chemiosmotic pump theory and the production of energy; • calculate energy yields from electron and proton transport; and • discuss the conversion of chemical energy to other forms of energy. 	10. Bioenergetics – Conversion of Food to Energy in the Body <ol style="list-style-type: none"> 1. Metabolism 2. Mitochondria and their Role in Metabolism 3. Principal Compounds of the Common Metabolic Pathway 4. The Citric Acid Cycle 5. The Electron and Proton Transport 6. The Chemiosmotic Pump in ATP Production 7. Energy Yield from Electron and Proton Transport 8. Conversion of Chemical Energy to Other Forms of Energy 	<ul style="list-style-type: none"> • Lecture Discussion • Video Presentation • Group Discussion 	<ul style="list-style-type: none"> • Formal Examinations • Recitations • Board Work • Seat Work • Problem Set
MIDTERM PERIOD ASSESSMENT			

FINAL PERIOD LEARNING PLAN

LEARNING OUTCOMES At the end of each topic, the students should be able to:	TOPICS	LEARNING ACTIVITIES/ TEACHING STRATEGIES	ASSESSMENT
<ul style="list-style-type: none"> • summarize the catabolic pathways; • explain the process of glycolysis, beta-oxidation of fatty acids, and amino acids catabolism and discuss their physiological roles; • identify the connections between the catabolic pathways; • calculate energy yields from the specific catabolic pathways; • define ketone bodies and discuss how they are formed; • discuss the fate of the nitrogen atom and the carbon skeleton of amino acids when catabolized; and • explain the catabolism of heme. 	11. Specific Catabolic Pathways: Carbohydrate, Lipid, and Protein Metabolism <ol style="list-style-type: none"> 1. General Outline of Catabolic Pathways 2. Glycolysis 3. Energy Yield from Glycolysis 4. Glycerol Catabolism 5. Beta-Oxidation of Fatty Acids 6. Energy Yield from Stearic Acid Catabolism 7. Ketone Bodies 8. Amino Acid Catabolism: Nitrogen Atom and Carbon Skeleton 9. Catabolism of Heme 	<ul style="list-style-type: none"> • Lecture Discussion • Video Presentation • Group Discussion 	<ul style="list-style-type: none"> • Formal Examinations • Recitations • Board Work • Seat Work • Problem Set
<ul style="list-style-type: none"> • summarize the biosynthetic pathways; • discuss the biosynthesis of carbohydrates, fatty acids, membrane lipids, and amino acids and explain their importance in biological systems. 	12. Biosynthetic Pathways <ol style="list-style-type: none"> 1. General Outline of Biosynthetic Pathways 2. Biosynthesis of Carbohydrates 3. Biosynthesis of Fatty Acids 4. Biosynthesis of Membrane Lipids 5. Biosynthesis of Amino Acids 	<ul style="list-style-type: none"> • Lecture Discussion • Video Presentation • Group Discussion 	<ul style="list-style-type: none"> • Formal Examinations • Recitations • Board Work • Seat Work • Problem Set
<ul style="list-style-type: none"> • measure nutrition; • count calories; • explain the absorption, transport, metabolism, and excretion of dietary nutrients; and • explain the importance of vitamins, minerals, and water. 	13, Nutrition <ol style="list-style-type: none"> 1. Nutrition Measurement 2. Counting Calories 3. Processing Dietary Carbohydrates 4. Processing Dietary Fats 5. Processing Dietary Proteins 6. Importance of Vitamins, Minerals, and Water 	<ul style="list-style-type: none"> • Lecture Discussion • Video Presentation • Group Discussion 	<ul style="list-style-type: none"> • Formal Examinations • Recitations • Board Work • Seat Work • Problem Set
<ul style="list-style-type: none"> • distinguish self from non-self; • explain how the body defends itself from invasion; • identify the organs and cells that make up the immune system; • describe the role of immunoglobulins; • describe the roles of T-Cells and T-Cell Receptors; • describe how the immune system is controlled; 	14. Immunochemistry <ol style="list-style-type: none"> 1. Self versus Non-self 2. Body Defense Against Non-Self 3. Organs and Cells that Make Up the Immune System 4. Antigens and the Immune System 5. Immunoglobulins 	<ul style="list-style-type: none"> • Lecture Discussion • Video Presentation • Group Discussion 	<ul style="list-style-type: none"> • Formal Examinations • Recitations • Board Work • Seat Work • Problem Set

<ul style="list-style-type: none"> • explain the significance of immunization; and • discuss how HIV causes AIDS. 	<ol style="list-style-type: none"> 6. T-Cells and T-Cell Receptors 7. Regulation of Immune Response 8. Immunization 9. HIV and AIDS 		
<ul style="list-style-type: none"> • identify the important body fluids; • describe the functions of the blood; • identify the composition of the blood; • describe how the blood acts as an oxygen-carrier; • describe how the blood transports carbon dioxide; • describe the role of the kidneys in cleansing the blood; • describe the role of the kidneys on the body's buffers; • describe how water and salt balance are maintained in blood and kidneys; and • describe the biochemistry and physiology of blood pressure. 	<p>15. Body Fluids</p> <ol style="list-style-type: none"> 1. Important Body Fluids 2. Functions and Composition of the Blood 3. The Blood as Oxygen Carrier 4. Transport of Carbon Dioxide in the Blood 5. Role of the Kidneys in Cleansing the Blood 6. Role of the Kidneys in the Body's Buffers 7. Maintenance of Water and Salt Balance in the Blood and Kidneys; 8. Biochemistry and Physiology of Blood Pressure 	<ul style="list-style-type: none"> • Lecture Discussion • Video Presentation • Group Discussion 	<ul style="list-style-type: none"> • Formal Examinations • Recitations • Board Work • Seat Work • Problem Set
FINAL PERIOD ASSESSMENT			

LEVELS OF ASSESSMENT

Lecture Components (60%)		Laboratory Components (40%)	
• Long Exams	25%	• Practical Exam	10%
• Major Exam	25%	• Major Exam/s	20%
• Others	10%	• Lab. Performance & Others	5%
		• Laboratory Reports a. Experiment Sheets b. Results & Discussion Reports (RDR)	5%
Total	60%	Total	40%

COMPUTATION OF GRADES

- Each form of assessment will be computed as follows:

$$\text{ASSESSMENT SCORE} = \frac{\text{RAW SCORE}}{\text{TOTAL SCORE}} \times 50 + 50$$

- At the end of the course, the final course output will be computed as follows:

$$\text{FINAL COURSE OUTPUT SCORE} = \frac{\text{GARNERED POINTS}}{\text{TOTAL POINTS}} \times 50 + 50$$

- At the end of the course, the final course grade will be computed as follows:

$$\text{FINAL COURSE GRADE} = \left(\frac{\text{PRELIM GRADE} + \text{MIDTERM GRADE} + \text{FINAL GRADE}}{3} \times 0.95 \right) + (\text{FINAL COURSE OUTPUT SCORE} \times 0.05) = 100$$

TEXTBOOK

- Bettelheim, F., Brown, W., Campbell, M., Farrell, S., and Torres, O. (2013). *Introduction to general, organic, and biochemistry* (10th ed.). Singapore: Cengage Learning.

OTHER REFERENCES

- Denniston, K., Topping, J., and Caret, R. (2007). *General, organic, and biochemistry* (5th ed.). Boston: McGraw-Hill Companies.
- Smith, J. (2012). *General, organic, and biological chemistry* (2nd ed.). Boston: McGraw-Hill Companies.
- Timberlake, K. (2011). *Chemistry: an introduction to general, organic, and biological chemistry* (11th ed.). Upper Saddle River, New Jersey: Prentice Hall, Inc.

COURSE POLICIES

- Students are allowed 20% of the total number of schooldays of absences inclusive of tardiness. All absences after that will mean excessive absences, which will merit a grade of 0.00.
- Home works will be due at the beginning of the class. No home works will be accepted thereafter.
- The students will be given a score of zero (0) with corresponding grade of zero percent (0%) in a requirement which is not submitted under the following conditions:
 - They are given a chance to make-up for the said requirement.
 - They are given enough time to work on the make-up requirement.
- The students will be given a score of zero (0) with corresponding grade of zero percent (0%) in a quiz which is given during their absence under the following conditions:
 - The absent is unexcused.
 - They are offered a make-up quiz and still fail to appear during the given time.
 - They are given enough time to prepare for the make-up quiz.
- In case the students submitted a requirement given by the instructor/professor to make-up for their lost grade, a certain percent will be deducted on their actual grade.
- Special major exams are scheduled one week after the administration of the major exams. No special exams will be given thereafter EXCEPT IN SPECIAL SITUATIONS.
- Students must be honest at all times; cheating and plagiarism in any form will merit a grade of 0.00.
- Cellular/Mobile phones should always be in silent mode during class hours; the use of cellular phones is prohibited in class unless a special permission is sought. Cellular phones cannot also be used as calculator during examination.
- Borrowing of calculators and modern periodic table of elements during examination is strictly prohibited.
- Wearing of laboratory gowns and safety goggles during experiments will be strictly implemented. No lab gown and safety goggles, no experiment.
- The laboratory instructor will not be held legally responsible to accidents due to student's unawareness of safety measures and non-compliance with experimental guidelines.
- Any complaints (teaching, grades, etc.) against the teacher or against classmates (relative to the class) should be properly addressed to the subject-teacher for appropriate action. Students may seek the help and guidance of their academic/registration adviser in resolving the issue with the subject-teacher.

All policies (attendance, tardiness, decorum, grievances, etc.) will be subject to the provisions of the latest revision of the Student Handbook.

Endorsed:



Tabitha L. Amora, RCh, PhD
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Head, Chemistry Department

Approved:



Margel G. Bonifacio, RCh, PhD
Dean, College of Humanities and Sciences