COURSE SYLLABUS

LAST REVIEW	Spring 2021
COURSE TITLE	Biochemistry
COURSE NUMBER	CHEM-0250
DIVISION	Math, Science, Business & Technology
DEPARTMENT	Chemistry
CIP CODE	24.0101
CREDIT HOURS	4
CONTACT HOURS/WEEK	Class: 4
PREREQUISITES	Organic Chemistry I, CHEM-0211 and Organic Chemistry I Lab, CHEM-213
COURSE PLACEMENT	None

COURSE DESCRIPTION
The biochemistry course is an introduction to the structure and functional relationships of the major bio-molecules including: proteins, lipids, carbohydrates, and nucleic acids. An overview of the major metabolic pathways and current techniques in molecular biology will also be provided.

TEXTBOOKS
http://kckccbookstore.com/

METHODS OF INSTRUCTION
A variety of instructional methods may be used depending on content area. These include but are not limited to: lecture, multimedia, cooperative/collaborative learning, labs and demonstrations, projects and presentations, speeches, debates, panels, conferencing, performances, and learning experiences outside the classroom. Methodology will be selected to best meet student needs.

COURSE OUTLINE
I. Aqueous Solutions and Biochemical Systems
   A. Intermolecular Forces
   B. Properties of Solutions
   C. Acids, Bases, and Buffer Systems.
   D. pH, pKa, and the Henderson-Hasselbach equation.
II. Amino Acids and Small Peptides
   A. Classify amino acids
   B. Stereochemistry of amino acids.

C. Functions of small peptides and amino acids.

III. Proteins
- A. The four levels of protein structure.
- B. Protein purification
- C. Principles of Column Chromatography.
- D. Determining primary structure
- E. Types of secondary structure.
- F. Tertiary structure of proteins.

IV. Enzymes
- A. Major classes of enzymes.
- B. Free energy, catalysts and kinetics.
- C. Michaelis-Menton.
- D. Inhibitors and activators.
- E. Allosteric enzymes.
- F. Enzyme Mechanisms.
- G. Coenzymes.

V. Lipids and Biological Membranes
- A. Classes of lipids.
- B. Properties of fatty acids.
- C. Properties of steroids.
- D. Synthesis and functions of eicosanoids.
- E. Lipid soluble vitamins.
- F. Cell membranes.
- G. Membrane transport.
- H. The Na+, K+-ATPase.
- I. Receptors.

VI. Carbohydrates
- A. Common monosaccharides and disaccharides.
- B. Polysaccharides.

VII. Thermodynamics and Biological Systems
- A. Equilibrium and spontaneity
- B. Standard reduction potentials.
- C. High energy groups utilized in metabolism.
- D. Catabolic and anabolic metabolism.

VIII. Carbohydrate Metabolism
- A. The reactions of glycolysis.
- B. Energetics of glycolysis.
- C. Glycogen metabolism.
- D. Gluconeogenesis.
- E. Pentose phosphate shunt
- F. The citric acid cycle.
- G. Mitochondria and the electron transport system.

IX. Photosynthesis
- A. The chloroplast.

B. The antenna complex.
C. Carotenoids
D. The light reactions of photosynthesis.

X. Lipid Metabolism
A. Lipoproteins.
B. Fatty acids transport.
C. Oxidation of a fatty acid.
D. Ketone bodies.
E. Fatty acid synthesis.
F. Phospholipid and cholesterol synthesis.

XI. Amino Acid Metabolism
A. The Nitrogen cycle.
B. Ketogenic and glycogenic amino acids.
C. Transamination reactions.
D. The urea cycle.

XII. Explain Aspects of the Structure of Nucleic Acids
A. Purines and pyrimidines.
B. B Nucleotides and nucleosides.
C. Primary structure of DNA.
D. Secondary structure of DNA.
E. Tertiary structures of DNA.

XIII. Molecular Biology
A. Sequencing DNA.
B. Replication is semiconservative.
C. DNA replication
D. Mutations in DNA.
E. DNA transcription.
F. Post-transcriptional modification of RNA.
G. The genetic code.
H. Structures of t-RNA, mRNA, and r-RNA.
I. Translation.
J. Post-translational modification of proteins.

XIV. Describe the Experimental Basis for Recombinant DNA Technology

COURSE LEARNING OUTCOMES AND COMPETENCIES

Upon successful completion of this course, the student will:

A. Be able to recognize the properties of water and their affects on dissolving substances in the body.
1. The student will be able to describe the properties of water, its intermolecular forces, and how these properties and forces relate to solution properties.
2. The student will be able to discuss the general properties of acids, bases, and buffers.
3. The student will be able to utilize the Henderson-Hasselbach Equation to determine pH for a buffer system.

B. Be able to recognize structure and function relationships of proteins, lipids, carbohydrates, and nucleic acids.
    4. The student will be able to draw the general structure of an amino acids and identify the 20 amino acids used in proteins.
    5. The student will be able to describe the characteristics of amino acids based on their side chains and subgroup them accordingly.
    6. The student will be able to describe the different levels of protein structure and describe how protein structural determinations are accomplished.
    7. The student will be able to describe the relationship between structure and function of proteins.

C. Be able to recognize the major classes of enzymes and relate these to the types of reactions a particular enzyme carries out.
    8. The student will be able to define the major classes of enzyme catalyzed reactions.
    9. The student will be able to explain principles of enzyme kinetics.
    10. The student will be able to describe three factors that control enzyme function.
    11. The student will be able to explain the lock and key and induced fit theories of enzyme-substrate interaction.
    12. The student will be able to discuss the likely amino acids in the active site of an enzyme based on its catalytic function.
    13. The student will be able to draw the mechanism for a class of enzymes such as serine proteases.

D. Be able to recognize the monomers for proteins, carbohydrates, nucleic acids, and lipids.
    14. The student will be able to compare and contrast the major classes of lipids and their functions.
    15. The student will be able to describe the Fluid Mosaic Model of biological membranes.
    16. The student will be able to compare the structures of mono-, di- and polysaccharides and give examples of each.
    17. The student will be able to describe the primary, secondary and tertiary structures of DNA and RNA.
    18. The student will be able to describe the process of DNA replication.
    19. The student will be able to describe the process of DNA transcription.
    20. The student will be able to describe the process of RNA translation.
    21. The student will be able to give a historical account of the development of the theory of molecular biology.

E. Be able to discuss metabolism as both catabolic and anabolic processes.
    22. The student will be able to utilize thermodynamic equations to determine energy relationships in metabolic reactions.

23. The student will be able to define catabolic and anabolic reactions and identify the catabolic and anabolic reactions involved with the major metabolic pathways.
24. The student will be able to describe and outline the metabolism of carbohydrates.
25. The student will be able to explain the Citric Acid Cycle and its relationship to the electron transport system.
26. The student will be able to describe the light and dark reactions of photosynthesis.
27. The student will be able to explain the process of lipid metabolism.
28. The student will be able to explain the process of protein and amino acid metabolism

F. Be able to discuss the aspects of molecular biology as they relate to genetic engineering and cloning.
29. The student will be able to describe the processes involved in DNA sequencing.
30. The student will be able to describe the process involved in reverse transcription.
31. The student will be able to describe the process of gene mapping.
32. The student will be able to describe the processes of gene regulation.
33. The student will be able to describe the process of genetic engineering.
34. The student will be able to explain the application PCR to DNA analysis.
35. The learner will be able to discuss metabolism as both catabolic and anabolic processes

ASSESSMENT OF COURSE LEARNING OUTCOMES AND COMPETENCIES
Student progress is evaluated through both formative and summative assessment methods. Specific details may be found in the instructor's course information document.

COLLEGE POLICIES AND PROCEDURES
Student Handbook
https://www.kckcc.edu/files/docs/student-resources/student-handbook-and-code-of-conduct.pdf

College Catalog
https://www.kckcc.edu/academics/catalog/index.html

College Policies and Statements
https://www.kckcc.edu/about/policies-statements/index.html

Accessibility and Accommodations
https://www.kckcc.edu/academics/resources/student-accessibility-support-services/index.html.