STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK

COURSE OUTLINE

CHEM 430-BIOCHEMISTRY

Prepared By: Nicole Heldt, Ph.D.

SCHOOL OF SCIENCE, HEALTH & CRIMINAL JUSTICE
May 2015

CHEM 430 Biochemistry

A. TITLE: Biochemistry

B. COURSE NUMBER: CHEM 430

C. CREDIT HOURS: 3

D. WRITING INTENSIVE COURSE (OPTIONAL): No

E. COURSE LENGTH: 15 weeks

F. SEMESTER(S) OFFERED: Spring

G. HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:
3 hours lecture per week.

H. CATALOG DESCRIPTION:

This course provides an introduction to the structure and function of biological macromolecules, bioenergetics, and transfer of genetic information. Emphasis will be on protein structure and function, enzyme catalysis, an overview of energy metabolism, and the maintenance and expression of genetic information.

I. PRE-REQUISITE: CHEM 302 Organic Chemistry II

J. STUDENT LEARNING OUTCOMES: Upon completion the student will be able to:

Course Objective	*Institutional SLO*
1. Describe the molecular basis of life and the organization of macromolecules	2. Crit. Thinking 3. Prof. Competence
2. Describe the physical and chemical properties of proteins and enzymes; relate structure to function of proteins; and explain enzyme catalysis and regulation; and apply thermodynamic and kinetic theories to enzyme reactions	2. Crit. Thinking 3. Prof. Competence
3. Describe the physical and chemical properties of lipids, their synthesis and function in membranes and metabolism	2. Crit. Thinking 3. Prof. Competence
4. Describe the central catabolic and anabolic carbohydrate pathways (glycolysis, gluconeogenesis, pentose phosphate pathway, citric acid cycle, electron transport and ATP Synthesis) and carbohydrate metabolism	2. Crit. Thinking 3. Prof. Competence
5. Relate the principles of thermodynamics and kinetics to energy utilization, biological organization and metabolic pathways	2. Crit. Thinking 3. Prof. Competence
6. Describe the physical and chemical properties of nucleic acids, DNA and RNA; explain the process of inheritance and protein synthesis and how it relates to viruses, cancer and immunology	2. Crit. Thinking 3. Prof. Competence

K. TEXTS:

Campbell, Mary K., Farrell, Shawn O. *Biochemistry, 8th edition*, Cengage Learning, Stamford, CT 2012

L. REFERENCES:

McKee, T., and McKee, J.R., *Biochemistry, The Molecular Basis of Life, 3rd edition*, McGraw Hill, New York, NY 2003.

M. EQUIPMENT: Scientific calculator that can do logarithms and powers of 10

N. GRADING METHOD: A-F

O. MEASUREMENT CRITERIA:
Exams and Quizzes
Assignments
Final Exam

P. DETAILED COURSE OUTLINE:

7. Introduction to Biochemistry: Biochemistry and the Organization of Cells
    a. Prokaryotic and Eukaryotic Cells
    b. Thermodynamics and free energy
        i. Role of ATP
8. Water: the Solvent for Biochemical Reactions
    c. Properties of water and intermolecular forces
    d. Acid base properties and buffers
9. Amino Acids and Peptides
    e. Structure and properties of amino acids
    f. The peptide bond and small peptides
10. The Three-Dimensional Structure of Proteins
    g. Protein structure and Function
    h. Primary structure
    i. Secondary structure
    j. Tertiary Structure (Globular and Fibrous structure)
        i. Myoglobin
    k. Quaternary structures of proteins
        i. Hemoglobin
    l. Protein denaturation and folding
11. Protein Purification and Characterization Techniques
12. The Behavior of Proteins: Enzymes
    m. enzymes as catalysts
    n. enzyme kinetics

o. enzyme substrate binding
p. enzyme inhibition (competitive, non-competitive)

13. The Behavior of Proteins: Enzymes, Mechanisms, and Control
    q. Allosteric enzymes
    r. Phosphorylation
    s. Active Sites
    t. Zymogens, Coenzymes and Vitamins
14. Lipids and Membranes
    u. The chemical Nature of the lipid types
        i. Fatty acids, triglycerides, phosphoglycerides, waxes, sphingolipids, glycolipids and steroids
    v. Biological membranes
        i. Lipid bilayers
        ii. Membrane proteins and Fluid mosaic model
        iii. Function of membranes
        iv. Lipid soluble vitamins, prostaglandins and leukotrienes
15. Nucleic Acids: How Structure Conveys Information
    w. Structures and properties of nucleotides and nucleic acids
        i. How DNA and RNA differ
    x. Structure of DNA
        i. Chromosomes and chromatin
    y. Denaturation of DNA
    z. Principle Kids of RNA and their Structure
16. Biosynthesis of Nucleic Acids: Replication
    aa. DNA Replication and polymerase
        i. Polymerization reaction mechanisms
    bb. Repair and Recombination
        i. mutation
17. Transcription of the Genetic Code: Biosynthesis of RNA
    cc. Transcription in prokaryotes and eukaryotes
        i. RNA Processing
    dd. Ribosomes
18. Protein Synthesis: Translation of the Genetic Message
    ee. The genetic code: Gene expression
    ff. Codon-anticodon interaction
    gg. Amino acid activation
    hh. Prokaryotic and Eukaryotic Translation
    ii. Protein degradation
19. Nucleic Acids Biotechnology Techniques
    jj. Genetic engineering
        i. Recombinant DNA Technology and cloning
    kk. DNA libraries and Fingerprinting
20. Viruses, Cancer and Immunology
    ll. Viruses and retroviruses
    mm. The immune system, cancer and aids
21. Electron Transfer in Metabolism

22. Carbohydrates
    nn. Structures and properties of mono-, di- and polysaccharides, glycoconjugates
23. Glycolysis
    oo. (reactions of the glycolic pathway
24. Gluconeogenesis,
    pp. Pentose Phosphate Pathway and Glycogen Metabolism
25. The Citric Acid Cycle
    qq. Oxidation reduction reactions
26. Electron Transport and ATP Synthesis
    rr. Electron transport components and inhibitors
    ss. Oxidative phosphoryilation and chemiosmitic coupling
27. Lipid Metabolism
    tt. Fatty acid degradation
28. Photosynthesis
29. The Metabolism of Nitrogen
    uu. Nitrogen fixation
    vv. Amino Acid Catabolism
        i. Urea cycle