DATE OF LAST REVIEW: 02/2013

CIP CODE: 24.0101

SEMESTER: Departmental Syllabus

COURSE TITLE: Biochemistry

COURSE NUMBER: CHEM-0250

CREDIT HOURS: 5

INSTRUCTOR: DEPARTMENTAL SYLLABUS

OFFICE LOCATION: DEPARTMENTAL SYLLABUS

OFFICE HOURS: DEPARTMENTAL SYLLABUS

TELEPHONE: DEPARTMENTAL SYLLABUS


REQUIRED TEXT AND MATERIALS:
Contact the Bookstore for the current textbook and supporting materials for this course.

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

METHOD 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, and 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.

II. Amino Acids and Small Peptides
   A. Classify amino acids
   B. Stereochemistry of amino acids.
   D. 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.
G. 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.
F. Lipid soluble vitamins.
H. Cell membranes.
I. Membrane transport.
J. The Na+, K+-ATPase.
K. 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. Nucleotides and nucleosides.
         C. Primary structure of DNA.
         D. Secondary structure of DNA.
         E. Tertiary structures of DNA.

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

XIV. **Describe the Experimental Basis for Recombinant DNA Technology**

**EXPECTED LEARNER OUTCOMES:**
1. The learner will be able to recognize the properties of water and their affects on dissolving substances in the body.
2. The learner will be able to recognize structure and function relationships of proteins, lipids, carbohydrates, and nucleic acids.
3. The learner will be able to recognize the major classes of enzymes and relate these to the types of reactions a particular enzyme carries out.
4. The learner will be able to recognize the monomers for proteins, carbohydrates, nucleic acids, and lipids.
5. The learner will be able to discuss metabolism as both catabolic and anabolic processes.
6. The learner will be able to discuss the aspects of molecular biology as they relate to genetic engineering and cloning.

**COURSE COMPETENCIES:**
Upon successful completion of this course:

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.
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.
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.
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 utilize thermodynamic equations to determine energy relationships in metabolic reactions.
18. The student will be able to define catabolic and anabolic reactions and identify the catabolic and anabolic reactions involved with the major metabolic pathways.
19. The student will be able to describe and outline the metabolism of carbohydrates.
20. The student will be able to explain the Citric Acid Cycle and its relationship to the electron transport system.
21. The student will be able to describe the light and dark reactions of photosynthesis.
22. The student will be able to explain the process of lipid metabolism.
23. The student will be able to explain the process of protein and amino acid metabolism.
24. The student will be able to describe the primary, secondary and tertiary structures of DNA and RNA.
25. The student will be able to describe the process of DNA replication.
26. The student will be able to describe the process of DNA transcription.
27. The student will be able to describe the process of RNA translation.
28. The student will be able to give a historical account of the development of the theory of molecular biology.
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 LEARNER OUTCOMES:**
Chemistry 250 Online will be assessed as follows:
Exams 40%
Discussion Participation  15%
Online Exercises and Homework  20%
Quizzes  10%
Journal  5%
Final Exam  10%

There will be four exams. The first and third exams will need to be proctored the second and fourth will be given online. Weekly quizzes will serve as practice for exams. Tutorial sites will also be provided. The final will be a comprehensive exam and will need to be proctored.

Each week there will be one or two questions assigned for your discussion. Participation is a must. Active discussion is important for processing the material.

Online assignments and homework will be given weekly. You will be able to complete this either on your own or as a member of a group.

You are expected to keep a journal of the hours you spend on the course. Please note that it typically takes 105 hours of class time to complete chemistry 250. This is a competency based course and you will have completed the course when you have completed the competencies. In your journal you may also keep a record of your experiences in the class. You will be asked to forward the journal to the instructor via email at the end of the course.

Note to Students Taking Online Classes:
The decision to take a class online as opposed to an onground class should be carefully considered before enrolling. It is true that online courses allow a student to be free of time and place. Class occurs when the student logs on to the computer at his or her convenience. It doesn’t matter if it’s 6:00 p.m. in the computing lab, Sunday afternoon at the local library, or 3:00 a.m. at home. The class will be there when the student is ready. That’s a wonderful advantage to those with full time jobs, full time families, transportation problems, special needs or interests.

However advantageous online courses appear to be, please consider the following:

- Online courses require extreme self-discipline. One must log on and be prepared to read through many pages and comments. It must be done regularly (3 -5 times per week) or the process can take several hours.
- A great deal of time is spent visiting web sites, reading articles, dealing with technical problems. Technology is unreliable. The plan to submit homework at the last moment can be defeated with a busy or down server.
- Sometimes the cyberdog eats your homework. That is no excuse for not submitting homework. You should always have a copy saved to a disk so you can resubmit. Failure to do so leads to more work.
- Most people who have taken online courses will tell you that it is more ‘labor intensive’ than onground courses. It just takes more time. In an online course every student contributes to the discussion. That rarely happens onground.
- Online classes tend to be accelerated. That is, material is covered at a faster pace. It would not be uncommon for an online class to cover in 10 or 12 weeks what an onground class covers in 16. This may not always be the case but it is possible.
- If you are not highly motivated, disciplined, and patient, online courses are not the best option. There are other forms of distance education that may be more appropriate for you.

SPECIAL NOTES:
This syllabus is subject to change at the discretion of the instructor. Material included is intended to provide an outline of the course and rules that the instructor will adhere to in evaluating the student’s progress. However, this syllabus is not intended to be a legal contract. Questions regarding the syllabus are welcome any time.

Kansas City Kansas Community College is committed to an appreciation of diversity with respect for the differences among the diverse groups comprising our students, faculty, and staff that is free of bigotry and discrimination. Kansas City Kansas Community College is committed to providing a multicultural education and environment that reflects and respects diversity and that seeks to increase understanding.

Kansas City Kansas Community College offers equal educational opportunity to all students as well as serving as an equal opportunity employer for all personnel. Various laws, including Title IX of the Educational Amendments of 1972, require the college’s policy on non-discrimination be administered without regard to race, color, age, sex, religion, national origin, physical handicap, or veteran status and that such policy be made known.

Kansas City Kansas Community College complies with the Americans with Disabilities Act. If you need accommodations due to a documented disability, please contact the Director of the Academic Resource Center, in Rm. 3354 or call: 288-7670.