

## Syllabus for CHEM 4301 (Spring 2016) (Alpine and Midland)

**Class:** Biochemistry I  
Room: WSB 321  
Time: MWF 11:00-11:50am

**Instructor:** Dr. David Leaver  
Office: WSB 318  
Office Hours: MWF 3:00-5:00pm  
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### *Program Learning Objectives (PLO):*

A student graduating with the chemistry major is expected to demonstrate that s(he) is able to:

1. Explain atomic and molecular structures, bonding, thermodynamics, chemical equilibria and kinetics, stoichiometry, and electrochemical processes;
2. Write and explain organic reactions, stereochemistry, and reactions in biological systems;
3. Use essential modern instruments to perform chemistry experiments in the laboratory;
4. Summarize basic principles of research design and analyze experimental data using appropriate computer programs (e.g. Excell, Sigma-plot, etc.) in regards to the chemistry discipline.

### *Student Learning Objectives (SLO):*

At the end of this course, a student should have a good understanding of:

1. Chemistry and biological functions of water, amino acids, and proteins
2. Enzyme reactions, kinetics and inhibition
3. The structure and biological function of carbohydrates and lipids
4. Biological membranes and cellular transport
5. Storage and transfer of biological information (DNA replication/transcription and RNA translation)

### **TEXT:**

Concepts in Biochemistry by Rodney Boyer (3rd Edition; recommended)

Or

Biochemistry by Garrett and Grisham (5th Edition)

The following chapters will be covered: (According to Boyer)

**Chapter 1:** Biochemistry: From Atoms to Molecules to Cells (SLO 1)

**Chapter 2:** Biomolecules in Water (SLO 1)

**Chapter 3:** Amino Acids, Peptides, and Proteins (SLO 1)

**Chapter 4:** Protein Architecture and Biological Function (SLO 1 and 2)

**Chapter 5:** Enzyme I: Reactions, Kinetics, and Inhibition (SLO 2)

**Chapter 6:** Enzyme II: Coenzymes, Regulation, Abzymes, and Ribozymes (SLO 2)

**Chapter 7:** Carbohydrates: Structure and Biological Function (SLO 1 and 3)

**Chapter 8:** Lipids: Structure and Biological Function (SLO 1 and 3)

**Chapter 9:** Biological Membranes and Cellular Transport (SLO 1 and 4)

**Chapter 10:** DNA and RNA: Structure and Function (SLO 5)

**Chapter 11:** DNA Replication and Transcription (SLO 5)

**Chapter 12:** Translation of RNA (SLO 5)

**This course is designed to fulfill PLO 1 and 2**

**ATTENDANCE PRERESQUITE: BEING ABSENT FROM MORE THAN 9 LECTURES WILL RESULT IN FAILING THE COURSE.**

#### **HOMEWORK:**

Twelve homework assignments will be assigned throughout the semester and will be equal weight per assignment. All of the combined homework assignments will contribute 20% of your final mark.

#### **EXAMINATIONS:**

There will *three in-course* examinations and *a final* examination. **NO MAKE-UP EXAMS WILL BE GIVEN.** The final is mandatory and will be comprehensive.

#### **PERCENTAGE BREAKDOWN OF MARKS:**

Homework: 20%

Each Midterm Exam (17.5%): 52.5%

Final Exam: 27.5%

**Midterm Exam I:** Wednesday, February 17<sup>th</sup>

**Midterm Exam II:** Wednesday, March 23<sup>rd</sup>

**Midterm Exam III:** Wednesday, April 20<sup>th</sup>

**Final Exam:** Wednesday, May 11<sup>th</sup> 10:15am -12:15 pm

## **Course Calendar**

**Lecture 1 (January 20):** Discussion on Syllabus, importance and historic background of biochemistry

**Lecture 2 (January 22):** Chemical elements in biomolecules, major classes of biological macromolecules, overview of organelles, cells, and organisms

**Lecture 3 (January 24):** Preview of storage and transfer of biological information + revision on chapter 1

**Lecture 4 (January 26):** Biological roles of water and cellular reactions of water  
**(Homework 1 due)**

**Lecture 5 (January 29):** overview of pH and pK, buffer and titration curves, General structure of amino acids, properties of  $\alpha$ -amino acids, classification of amino acids, reactivity and analysis of amino acids

**Lecture 6 (February 1):** Revision on Chapter 2 + peptide bonds in polypeptides and proteins

**Lecture 7 (February 3):** Preview of protein function and structural properties of proteins  
**(Homework 2 due)**

**Lecture 8 (February 5):** Structural elements of proteins-primary, secondary, tertiary and quaternary structures, protein folding process

**Lecture 9 (February 8):** Understanding the relation between protein structure and biological function with few examples + revision on Chapter 3

**Lecture 10 (February 10):** General principles of protein design, elements of secondary structure and protein tertiary structure **(Homework 3 due)**

**Lecture 11 (February 12):** Protein quaternary structure and more examples of protein structure and related biological function

**Lecture 12 (February 15):** Exam revision on Chapters 1-3

**Lecture 13 (February 17):** Exam I (Chapters 1-3)

**Lecture 14 (February 19):** Revision on Chapter 4 + roles and properties of enzymes

**Lecture 15 (February 22):** Fundamental principles of enzyme action and kinetic properties of enzymes (**Homework 4 due**)

**Lecture 16 (February 24):** Substrate binding and enzyme action, enzyme inhibition

**Lecture 17 (February 26):** Revision on Chapter 5

**Lecture 18 (February 29):** Role of coenzymes in the activity of enzymes, allosteric enzymes (**Homework 5 due**)

**Lecture 19 (March 2):** Cellular regulation of enzymes, introduction to site-directed mutagenesis, ribozymes, and practical uses of enzymes

**Lecture 20 (March 4):** Revision on Chapter 6

**Lecture 21 (March 7):** Introduction to carbohydrate chemistry, classification of carbohydrates, reactions of monosaccharides (**Homework 6 due**)

**Lecture 22 (March 9):** Structures and functions of polysaccharides and glycoproteins

**Lecture 23 (March 11):** Revision on Chapter 7; Chemical structures, physical and chemical properties of fatty acids

**March 14-18<sup>th</sup> is Spring Break (No classes)**

**Lecture 24 (March 21):** Exam revision on Chapter 3-6; (**Homework 7 due**)

**Lecture 25 (March 23):** Exam II (Chapters 3-6)

**Lecture 26 (March 25):** Good Friday (No Class)

**Lecture 27 (March 28):** Polar and non-polar lipids

**Lecture 28 (March 30):** Revision on Chapter 8 + Chemical structures and biological properties of steroids and other lipids

**Lecture 29 (April 1):** Molecular composition, architecture, and biological functions of cell Membranes (**Homework 8 due**)

**Lecture 30 (April 4):** Modes of action used by membrane transport proteins

**Lecture 31 (April 6):** Revision on Chapter 9 + Chemical structures of DNA and RNA

**Lecture 32 (April 8):** Structural elements of DNA and RNA, DNA and RNA cleavage by nucleases and nucleic acid-protein complexes

**Lecture 33 (April 11):** Revision on Chapter 10; DNA replication- machinery and process

**Lecture 34 (April 13):** DNA damage and repair (**Homework 10 due**)

**Lecture 35 (April 15):** Cellular and molecular mechanism for RNA synthesis, posttranscriptional modifications of RNA

**Lecture 36 (April 18):** Exam revision on Chapters 7-10

**Lecture 37 (April 20):** Exam III; Chapters 7-10

**Lecture 38 (April 22):** Revision on Chapter 11

**Lecture 39 (April 25):** Cellular and molecular components and general features of protein synthesis process (**Homework 11 due**)

**Lecture 40 (April 27):** Post-translational processing of proteins, regulation of protein synthesis and gene expression

**Lecture 41 (April 29):** Revision on Chapter 12

**Lecture 42 (May 2):** Final Exam Revision (Chapters 1-6); (**Homework 12 due**)

**Lecture 43 (May 4):** Final Exam Revision (Chapters 7-12)

**Final Exam (May 11):** At 10:15 am-12:145 pm (Chapters 1-12)

**Distance Education Statement:** Students enrolled in distance education courses have equal access to the university's academic support services, library resources, and instructional technology support. For more information about accessing these resources, visit the SRSU website. Students should submit online assignments through Blackboard or SRSU email, which require secure login information to verify students' identities and to protect students' information. The procedures for filing a student complaint are included in the student handbook. Students enrolled in distance education courses at Sul Ross are expected to adhere to all policies pertaining to academic honesty and appropriate student conduct, as described in the student handbook.

**Students with Special Needs:** *Sul Ross State University is committed to equal access in compliance with the Americans With Disabilities Act of 1973. It is the student's responsibility to initiate a request for accessibility services. Students seeking accessibility services must contact Mary Schwartz, M. Ed., L.P.C., in Counseling and Accessibility Services, Ferguson Hall, Room 112. The mailing address is P.O. Box C-122, Sul Ross State University, Alpine, Texas 79832. Telephone: 432-837-8203. E-mail: mschwartz@sulross.edu.*

**Scholastic Dishonesty:** *Students who violate the University rules on scholastic dishonesty are subject to penalties, including the possibility of an **F** in the course and/or dismissal from the University. All assignments (including homework) need to be individually completed and not copied from another student's work. Electronic submission of homework is accepted after hours (not recommended), but must be hand written and scanned (either with a scanner or a smart phone) and emailed to Dr. Leaver at: [djl14jh@sulross.edu](mailto:djl14jh@sulross.edu) or [david.leaver@sulross.edu](mailto:david.leaver@sulross.edu). Homework electronically completed in Microsoft Word or other similar programs will NOT be accepted.*