

**Sul Ross State University**  
**Syllabus for Biochemistry I: CHEM 4301 (Spring 2020)**  
**(Alpine and Midland)**

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

**Instructor:** Dr. David Leaver  
Office: WSB 318  
Office Hours: M-R 2:00-5:00pm  
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## OBJECTIVES

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

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

1. Organic Chemistry—Students will be able to draw organic molecular structures and explain organic reactions, stereochemistry, structural analysis and reactions in biological systems.
2. Inorganic Chemistry—The student will be able to demonstrate understanding of coordination chemistry, valence theory, elementary actions and advanced molecular theory.
3. Analytical Chemistry—The student will be able to demonstrate an understanding of theory of analytical chemistry and conduct analytical analysis, including data analysis and calibration, equilibrium chemistry, gravimetric analysis, titrimetric analysis, spectroscopic analysis, and electrochemical analysis.
4. Physical Chemistry—The student will be able to demonstrate an understanding of the application and theory of physical chemistry, including topics such as atomic structure, electrochemistry, surface chemistry, solid-state chemistry, and thermodynamics.
5. Research—The student will collect and analyze published chemical literature and undertake a chemistry research project.

### ***BSc in Chemistry Marketable Skills***

1. Students will become good at punctuality and time management.
2. Students will analyze &/or synthesize molecules and perform spectroscopic characterization and interpret their results scientifically.
3. Students will become proficient at writing scientific papers and to identify appropriate references for their paper.
4. Students will be become proficient at orally presenting scientific topics including the use of visual aids.

### ***Biochemistry I Learning Objectives:***

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)
6. SciFinder (Chemical Database)

***Calculator:*** A scientific calculator is required for this course.

***Cell phones*** **ARE NOT** permitted for use in exams and should be turned off during class time.

### **REQUIRED TEXT:**

“Lehninger Principles of Biochemistry” 6<sup>th</sup> Edition, David L. Nelson & Michael M. Cox, **2013**, W.H. Freeman and Company, New York.

**Optional reading:** “Concepts in Biochemistry” by Rodney Boyer, 2006, (3rd Edition), John Wiley & Sons, INC.

The following chapters will be covered from “Lehninger Principles of Biochemistry” 6th Edition:

**Chapter 1:** The Foundations of Biochemistry

**Chapter 2:** Water

**Chapter 3:** Amino Acids, Peptides, and Proteins

**Chapter 4:** The Three-Dimensional Structure of Proteins

**Chapter 5:** Protein Function

**Chapter 6:** Enzymes

**Chapter 7:** Carbohydrates and Glycobiology

**Chapter 10:** Lipids

**Chapter 11** Biological Membranes and Transport

**Chapter 8:** Nucleotides and Nucleic Acids

**Chapter 24:** Genes and Chromosomes

**Chapter 25:** DNA Metabolism

**Chapter 26:** RNA Metabolism (*If time permits*)

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

### **HOMEWORK:**

Thirteen (13) 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. Homework must be completed in **PEN!**

### **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%

Research Essay: 15%

Each Midterm Exam (15%): 45%

Final Exam: 20%

**Midterm Exam I:** Wednesday, February 12<sup>th</sup>

**Midterm Exam II:** Wednesday, March 18<sup>th</sup>

**Midterm Exam III:** Wednesday, April 15<sup>th</sup>

**Research Essay:** Monday, April 6<sup>th</sup> (Due 5:00 pm)

**Final Exam:** Tuesday, May 5<sup>th</sup> 10:15am -12:15 pm

## **Course Calendar**

**Lecture 1 (January 13):** Discussion on Syllabus, importance and historic background of Biochemistry, cellular foundations, overview of organelles, cells, and organisms

**Lecture 2 (January 15):** Chemical elements in biomolecules, major classes of biological macromolecules, chemical and physical foundations.

**Lecture 3 (January 17):** Preview of storage and transfer of biological information, genetic foundations + revision on chapter 1

**January 20: Martin Luther King, Jr. holiday (No Class)**

**Lecture 4 (January 22):** Biological roles of water and cellular reactions of water (**Homework 1 due**)

**Lecture 5 (January 24):** 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 (January 27):** Revision on Chapter 2 + peptide bonds in polypeptides and proteins. (**Homework 2 due**)

**Lecture 7 (January 29):** Preview of protein function and structural properties of proteins

**Lecture 8 (January 31):** Structural elements of proteins-primary, secondary, tertiary and quaternary structures, protein folding process

**Lecture 9 (February 3):** Revision on Chapter 3 General principles of protein design (**Homework 3 due**)

**Lecture 10 (February 5):** Elements of secondary structure and protein tertiary structure

**Lecture 11 (February 7):** Protein quaternary structure and more examples of protein structure and related biological function, revision on Chapter 4 (**Homework 4 due**)

**Lecture 12 (February 10): Exam revision on Chapters 1-3**

**Lecture 13 (February 12): Exam I (Chapters 1-3, subject to change)**

**Lecture 14 (February 14):** Understanding the relation between protein structure and biological function with few examples

**Lecture 15 (February 17):** More examples of protein function, revision on Chapter 5, roles and properties of enzymes

**Lecture 16 (February 19):** Fundamental principles of enzyme action and kinetic properties of enzymes

**Lecture 17 (February 21):** Substrate binding and enzyme action, enzyme inhibition, enzymatic reaction examples (**Homework 5 due**)

**Lecture 18 (February 24):** Role of coenzymes in the activity of enzymes, allosteric enzymes

**Lecture 19 (February 26):** Cellular regulation of enzymes, more enzyme reactions and practical uses of enzymes

**Lecture 20 (February 28):** Revision on Chapter 6 (**Homework 6 due**)

**Lecture 21 (March 2):** Introduction to carbohydrate chemistry, classification of carbohydrates, reactions of monosaccharides

**Lecture 22 (March 4):** Structures and functions of polysaccharides and glycoproteins

**Lecture 23 (March 6):** Revision on Chapter 7, Chemical structures, physical and chemical properties of fatty acids (**Homework chapter 7 due**)

**March 9-13<sup>th</sup> is Spring Break (No classes)**

**Lecture 24 (March 16): Exam revision on Chapters 4-7**

**Lecture 25 (March 18): Exam II (Chapters 4-7, subject to change)**

**Lecture 26 (March 20):** Polar and non-polar lipids, structural lipids in membranes, and importance of lipids

**Lecture 27 (March 23):** Working with lipids and revision on Chapter 10

**Lecture 28 (March 25):** Molecular composition, architecture, and biological functions of cell  
**(Homework chapter 10 due)**

**Lecture 29 (March 27):** Membrane dynamics

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

**Lecture 31 (April 1):** Revision on Chapter 11 (**Homework Chapter 11 due**), chemical structures of DNA and RNA

**Lecture 32 (April 3):** Structural elements of DNA and RNA, functions of nucleotides,

**Lecture 33 (April 6):** Revision on Chapter 8; chromosomal elements, DNA supercoiling,  
**Research Essay due 5:00 pm**

**Lecture 34 (April 8):** Structure of chromosomes (**Homework Chapter 8 due**)

**April 10: Good Friday (No Class)**

**Lecture 35 (April 13): Exam revision on Chapters 8, 10, 11**

**Lecture 36 (April 15): Exam III; Chapters 8, 10, 11 (subject to change)**

**Lecture 37 (April 17):** Revision on Chapter 24, (**Homework Chapter 24 due**)

**Lecture 38 (April 20):** DNA replications, DNA repair, DNA replication

**Lecture 39 (April 22):** Revision on Chapter 25, DNA-dependent synthesis of RNA (**Homework Chapter 25 due**)

**Lecture 40 (April 24):** RNA processing and RNA-dependent synthesis of RNA and DNA

**Lecture 41 (April 27):** Revision on Chapter 26, Final Exam Revision (**Homework Chapter 26 due**)

**Lecture 42 (April 29): Final Exam Revision**

**Final Exam (May 5): At 10:15 am-12:15 pm (Comprehensive)**

**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 handbo

**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 SRSU policy to provide reasonable accommodations to students with documented disabilities. It is the student's responsibility to initiate a request for accessibility services. Students seeking accessibility services must contact Ms. Rebecca Greathouse Wren, M.Ed., LPC-S, Director/Counselor, Accessibility Services Coordinator, 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: [rebecca.wren@sulross.edu](mailto:rebecca.wren@sulross.edu). Students should then contact the instructor as soon as possible to initiate the recommended accommodations.*

**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, but must be hand written and scanned (either with a scanner or a smart phone) and emailed to Dr. Leaver at: [david.leaver@sulross.edu](mailto:david.leaver@sulross.edu). [.pdf files are the recommended format for electronic submission of assignments]. Homework electronically completed in Microsoft Word or other similar programs will NOT be accepted.*