Sul Ross State University
Syllabus for Biochemistry I: CHEM 4301 (Spring 2021)
(Alpine and Midland)

Class: Biochemistry I  
Room: WSB 101  
Time: MWF 11:00-11:50am

Instructor: Dr. David Leaver  
Office: WSB 318  
Virtual Office Hours:  
M-R 2:00-5:00pm (phone or Zoom)  
Zoom (appointments only)  
Email: david.leaver@sulross.edu  
Office Phone: (432) 837-8115

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 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)

**REQUIRED RESOURCES AND TEXTS:**

You **must** wear a suitable mask/face covering while on campus. You will be asked to leave the classroom if you come to class without a suitable mask/face covering.


Assigned seating for Alpine students: please pick a seat in the classroom and you will be required to sit in the same seat for every class you attend in person.
Disinfection of Classroom Surfaces: Each person should disinfect their space at the beginning and end of every class meeting. The university has provided disinfectant wipes in the classroom. When you enter the classroom, please take a wipe and use it to clean your space before settling in. Please wipe down your space before you leave the classroom.

Orderly Dismissal: When class is over, Dr. Leaver will dismiss students row by row. Please wipe down your desk/leave when Dr. Leaver dismisses your row.

Food & Drinks: There will be no eating or drinking in the classroom. If you need to take a sip of your drink during class time, you may leave the room to do so.

If you have tested positive for COVID-19 (or have been exposed to someone who has tested positive for COVID-19), please self-report: https://srinfo.sulross.edu/covid-19/self-report/. In order to self-report you will need to be signed in with your SRSU credentials (yellow “log in” button on the bottom left hand side of the above website).

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.

SRSU Library Services: The Sul Ross Library offers FREE resources and services to the entire SRSU community. Access and borrow books, articles, and more by visiting the library’s website, library.sulross.edu. Off-campus access requires your LoboID and password. Check out materials using your photo ID. Librarians are a tremendous resource for your coursework and can be reached in person, by email (srsulibrary@sulross.edu), or phone (432-837-8123).

ChemDraw is a computer program that you can use to draw organic structures, organic reactions, etc. You can download ChemDraw onto your own personal computer (PC or Mac):

http://sitelicense.cambridgesoft.com/sitelistlicense.cfm?sid=3000

Make sure you follow the requirements for the password and use your SRSU email address to register.
Alternatively you can access ChemDraw in the GIS lab (computer room next to the chem TA room) by searching for “ChemDraw” whenever there is no class in that room (open computer lab when no classes are being taught).
REQUIRED TEXT:

The SRSU library has one copy of this textbook in the “Textbook Collection” section. Please ask the library front desk if you need help finding this textbook.


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

RESEARCH ESSAY:

You are required to prepare a 5 page (minimum) paper (excluding bibliography) that summarizes your findings in the literature of a particular topic in the field of biochemistry. The topic can be chosen by talking to Dr. Leaver directly or by taking one of the assigned projects. Your bibliography should have > 5 peer-reviewed articles or citations that pertain to your topic of interest. Website citations WILL NOT be accepted. You will need to turn in a soft copy (email .pdf) of the journal articles that you cite to Dr. Leaver or hand in a physical hard copy of the cited journal articles by the deadline. More information will be provided in class and in a separate handout in Blackboard. Due: Monday, March 29th at 11:59 pm CDT.

PERCENTAGE BREAKDOWN OF MARKS:

Homework: 20%
Research Essay: 15%
Each Midterm Exam (15%): 45%
Final Exam: 20%

Midterm Exam I: Monday, February 8th
Midterm Exam II: Monday, March 1st
Midterm Exam III: Wednesday, April 7th
Research Essay: Monday, March 29th (Due 11:59 pm CDT)
Final Exam: Tuesday, May 4th 10:15am -12:15 pm

Course Calendar

Lecture 1 (January 11): Discussion on Syllabus, importance and historic background of Biochemistry, cellular foundations, overview of organelles, cells, and organisms (online recording)

Lecture 2 (January 13): Chemical elements in biomolecules, major classes of biological macromolecules, chemical and physical foundations (online recording)
Lecture 3 (January 15): Preview of storage and transfer of biological information, genetic foundations + revision on chapter 1 (online recording) (Homework 1 due)

January 18: Martin Luther King, Jr. holiday (No Class)

Lecture 4 (January 20): Biological roles of water and cellular reactions of water (online recording)

Lecture 5 (January 22): 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 (online recording)

Lecture 6 (January 25): Revision on Chapter 2 + peptide bonds in polypeptides and proteins. (Homework 2 due)

Lecture 7 (January 27): Preview of protein function and structural properties of proteins

Lecture 8 (January 29): Structural elements of proteins-primary, secondary, tertiary and quaternary structures, protein folding process

Lecture 9 (February 1): Revision on Chapter 3 General principles of protein design (Homework 3 due)

Lecture 10 (February 3): Elements of secondary structure and protein tertiary structure

Lecture 11 (February 5): Exam revision on Chapters 1-3

Lecture 12 (February 8): Exam I (Chapters 1-3, subject to change)

Lecture 13 (February 10): Protein quaternary structure and more examples of protein structure and related biological function, revision on Chapter 4

Lecture 14 (February 12): Understanding the relationship between protein structure and biological function with few examples (Homework 4 due)

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

Lecture 16 (February 17): Fundamental principles of enzyme action and kinetic properties of enzymes (Homework 5 due)

Lecture 17 (February 19): Substrate binding and enzyme action, enzyme inhibition, enzymatic reaction examples

Lecture 18 (February 22): Role of coenzymes in the activity of enzymes, allosteric enzymes

Lecture 19 (February 24): Cellular regulation of enzymes, more enzyme reactions and practical uses of enzymes, revision on Chapter 6 (Homework 6 due)
Lecture 20 (February 26): Exam revision on Chapters 4-6
Lecture 21 (March 1): Exam II (Chapters 4-6, subject to change)
Lecture 22 (March 3): Introduction to carbohydrate chemistry
Lecture 23 (March 5): Classification of carbohydrates, reactions of monosaccharides

March 8-12th is Spring Break (No classes)

Lecture 24 (March 15): Structures and functions of polysaccharides and glycoproteins
Lecture 25 (March 17): Revision on Chapter 7, Chemical structures, physical and chemical properties of fatty acids (Homework chapter 7 due)
Lecture 26 (March 19): Polar and non-polar lipids, structural lipids in membranes, and importance of lipids
Lecture 27 (March 22): Working with lipids and revision on Chapter 10
Lecture 28 (March 24): Molecular composition, architecture, and biological functions of cell (Homework chapter 10 due)
Lecture 29 (March 26): Membrane dynamics
Lecture 30 (March 29): Modes of action used by membrane transport proteins. Research Essay due 11:59 pm
Lecture 31 (March 31): Revision on Chapter 11 (Homework Chapter 11 due), chemical structures of DNA and RNA

April 2: Good Friday (No Class)

Lecture 32 (April 5): Exam revision on Chapters 7, 10, 11
Lecture 33 (April 7): Exam III; Chapters 7, 10, 11 (subject to change)
Lecture 34 (April 9): Structural elements of DNA and RNA, functions of nucleotides
Lecture 35 (April 12): Revision on Chapter 8; chromosomal elements, DNA supercoiling (Homework Chapter 8 due)
Lecture 36 (April 14): Structure of chromosomes
Lecture 37 (April 16): Revision on Chapter 24, (Homework Chapter 24 due)
Lecture 38 (April 19): DNA replications, DNA repair, DNA replication
Lecture 39 (April 21): Revision on Chapter 25, DNA-dependent synthesis of RNA (Homework Chapter 25 due)
Lecture 40 (April 23): RNA processing and RNA-dependent synthesis of RNA and DNA
Lecture 41 (April 26): Revision on Chapter 26, Final Exam Revision (Homework Chapter 26 due)

Lecture 42 (April 28): Final Exam Revision

Final Exam (May 4): 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 handbook.

**ADA Statement:** Sul Ross State University is committed to equal access in compliance with the Americans With Disabilities Act of 1973. Students with qualifying disabilities who seek accommodations must initiate a request for a meeting for accessibility services. Students seeking accessibility services must contact Rebecca Greathouse Wren, M.Ed., LPC-S, Counseling & Accessibility Services, Telephone: 432-837-8203, or E-mail: rebecca.wren@sulross.edu. For more information see: [https://www.sulross.edu/page/1384/accessibility-services](https://www.sulross.edu/page/1384/accessibility-services)

**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 but it must be handwritten and scanned (either with a scanner or a smart phone) and emailed to Dr. Leaver at: david.leaver@sulross.edu. [.pdf files are the recommended format for electronic submission of assignments].