

Sul Ross State University
Syllabus for Organic Chemistry II: CHEM 3408 (Spring 2020)

Class: Organic Chemistry II
Room: WSB 307
Time: MWF 9:00-9:50am
Lab: Wednesday 2:00-4:50pm

Instructor: Dr. David J. Leaver
Office: WSB 318
Office Hours: M-R 3:00-5:00pm
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 be become proficient at orally presenting scientific topics including the use of visual aids.

Organic Chemistry II Learning Objectives:

- A. The language of aromatic based organic chemistry
- B. Reactions and mechanisms of compounds with carbonyl and amino groups
- C. In depth retrosynthetic analysis to design complex organic molecules
- D. Basic organometallic reactions and catalytic cycles
- E. How to write a chemical essay in the language of organic chemistry
- F. SciFinder (Chemical Database)

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

Required Text: “Organic Chemistry” by T. W. Solomons, C. B. Fryle and S.A. Snyder (11th ed.), **2014**, John Wiley & Sons (older editions are ok).

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

Lab Manual: “Techniques and Experiments for Organic Chemistry” (6th Edition) by A. Ault, **1998**, University Science Books; (Molecular Model Set optional)

Suggested reading: “Survival guide to organic chemistry: bridging the gap from general chemistry” by Patrick E. McMahon, Bohdan B. Khomtchouk and Claes Wahlestedt, **2017**, CRC Press, Taylor & Francis Group.

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

The following chapters will be covered:

Chapter 11: Alcohols and Ethers: Synthesis & Reactions

Chapter 12: Alcohols from Carbonyl compounds

Chapter 13: Conjugated Unsaturated Systems

Chapter 14: Aromatic Compounds

Chapter 15: Reactions of Aromatic Compounds

Chapter 16: Aldehydes and Ketones: Nucleophilic Addition to the Carbonyl Group

Chapter 17: Carboxylic Acids and their Derivatives

Chapter 18: Reactions at the α Carbon of Carbonyl Compounds: Enols and Enolates

Chapter 19: Condensation and Conjugate Addition Reactions of Carbonyl Compounds

Chapter 20: Amines

Chapter 21: Phenols and Aryl Halides: Nucleophilic Aromatic Substitution

Special Topic G: Carbon-Carbon Bond-Forming and Other Reactions of Transition Metal Organometallic Compound (*if time permits*).

Homework: There will be problems assigned for each chapter. **NO LATE HOMEWORK WILL BE ACCEPTED.** Homework must be completed in **PEN!**

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

LABORATORY: Attendance to laboratories is required. **NO MAKE-UP LABORATORIES WILL BE GIVEN.** If you **miss 3 labs** or more you will receive an automatic **F** for this course (i.e. this means you will fail the entire Organic II course).

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

PERCENTAGE BREAKDOWN OF MARKS:

Homework: 15%

Each Midterm Exam (12%): 36%

Research Essay 14%

Final Exam: 15%

Laboratory: 20%

Midterm Exam I: Monday, February 10th
Midterm Exam II: Wednesday, March 4th
Midterm Exam III: Wednesday, April 8th
Research Essay: Friday, April 17th (Due @ 5:00 pm)
Final Exam: Tuesday, May 5th at 8:00-10:00 am

Course Calendar

Lecture 1 (January 13): Discussion on syllabus, structure and nomenclature of alcohols, general physical and chemical properties of alcohols

Lecture 2 (January 15): Reactions of alcohols, overview of reactions of carbonyl compounds with nucleophiles

Lecture 3 (January 17): Revision on Chapter 11

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

Lecture 4 (January 22): Preparation of alcohols from carbonyl compounds (**Homework Chapter 11 due**)

Lecture 5 (January 24): Oxidation of alcohols, reactions of organolithium and organomagnesium compounds

Lecture 6 (January 27): Revision on Chapter 12

Lecture 7 (January 29): Allylic substitution reactions (**Homework Chapter 12 due**)

Lecture 8 (January 31): 1,3-butadiene and stability of conjugated dienes

Lecture 9 (February 3): 1,4 addition on conjugated dienes, Diels-Alder reaction

Lecture 10 (February 5): Revision on Chapter 13; Review on aromatic compounds. Nomenclature of benzene derivatives (**Homework chapter 13 due**)

Lecture 11 (February 7): Exam revision

Lecture 12 (February 10): Exam I (Chapters 11-13, subject to change)

Lecture 13 (February 12): Differences between alkenes and benzenes compounds in terms of general reactions

Lecture 14 (February 14): Stability of benzene; Revision on Chapter 14

Lecture 15 (February 17): Electrophilic aromatic substitution reactions (**Homework chapter 14 due**)

Lecture 16 (February 19): Friedel-Crafts alkylation/acylation

Lecture 17 (February 21): Effect of substituents on reactivity and orientation, synthetic applications, revision on Chapter 15

Lecture 18 (February 24): Nomenclature of aldehydes and ketones, synthesis of aldehydes and ketones, nucleophilic addition to the carbon-oxygen double bond (**Homework chapter 15 due**)

Lecture 19 (February 26): Synthesis of hemiacetals and acetals, addition of primary and secondary amines to carbonyl groups, Wittig reaction; Revision on Chapter 16

Lecture 20 (February 28): Nomenclature and physical properties of carboxylic acids and acid derivatives, preparation of carboxylic acids (**Homework chapter 16 due**)

Lecture 21 (March 2): Exam revision

Lecture 22 (March 4): Exam II (Chapters 14-16 subject to change)

Lecture 23 (March 6): Synthesis and reactions of esters and amides

March 9-13th is Spring Break (No classes)

Lecture 24 (March 16): Decarboxylation of carboxylic acids, summary of the reactions of carboxylic acids and their derivatives, review on Chapter 17 (**Homework chapter 17 due**)

Lecture 25 (March 18): Reactions via enols and enolate anions

Lecture 26 (March 20): Acetoacetic and malonic ester syntheses, enamine chemistry

Lecture 27 (March 23): Review on Chapter 18

Lecture 28 (March 25): Claisen & Dieckmann condensation reactions, (**Homework chapter 18 due**)

Lecture 29 (March 27): Aldol condensations continued

Lecture 30 (March 30): Addition to unsaturated aldehydes and ketones

Lecture 31 (April 1): Synthesis of substituted acetic acids, Michael additions, summary of important reaction of dicarbonyl compounds Revision on Chapter 19.

Lecture 32 (April 3): Nomenclature and physical properties of amines, basicity of amines, amines vs. amides, preparation of amines (**Homework chapter 19 due**)

Lecture 33 (April 6): Exam revision

Lecture 34 (April 8): Exam III: Chapters 17-19 (subject to change)

April 10: Good Friday (No Class)

Lecture 35 (April 13): Reactions of amines, revision on Chapter 20

Lecture 36 (April 15): Structure and nomenclature of phenols, physical properties and synthesis of phenols (**Homework chapter 20 due**)

Lecture 37 (April 17): Reactions of phenols, *Research Essay due @ 5:00 pm.*

Lecture 38 (April 20): Reactions of phenols continued

Lecture 39 (April 22): Revision on Chapter 21

Lecture 40 (April 24): Special Topic G (**Homework chapter 21 due**)

Lecture 41 (April 27): Revision on Special Topic G, Final Exam Revision

Lecture 42 (April 29): **Final Exam Revision (Homework Special Topic G due)**

Final Exam (May 5): 8:00 am-10:00 am in WSB 307 (comprehensive)

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. Students should then contact the instructor as soon as possible to initiate the recommended accommodations.*

Please inform Dr. Leaver and Organic Chemistry TA if you are pregnant or get pregnant during this semester as chemicals used in the Organic Chemistry laboratory could have harmful effects on an unborn child and extra safety precautions and due diligence need to be taken into consideration during laboratory periods.

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: david.leaver@sulross.edu. [.pdf is the preferred format for electronically submitted homework.] Homework electronically completed in Microsoft Word or other similar programs will **NOT** be accepted.*