

Sul Ross State University
Syllabus for CHEM 3408 (Spring 2015)

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: T-F 3:00-5:00pm
Email: djl14jh@sulross.edu
Office Phone: (432) 837-8115

Program Learning Objectives (PLO):

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

1. Explain atomic & molecular structures, bonding, thermodynamics, chemical equilibria & 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. Excel, Sigma-plot, etc.) in regards to the chemistry discipline

Student Learning Objectives (SLO):

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

- A. Infrared (IR), nuclear magnetic resonance (NMR) and mass spectroscopy
- B. the language of aromatic based organic chemistry
- C. Reactions and mechanisms of compounds with carbonyl and amino groups
- D. In depth retrosynthetic analysis to design complex organic molecules
- E. Biologically important molecules and their properties and functions

Text: Organic Chemistry by Solomons and Fryle (11th Edition); Lab Manual: Techniques and Experiments for Organic Chemistry by Ault; Molecular Model Set (which may be purchased from Student Center)

The following chapters will be covered:

Chapter 2.16: Infrared Spectroscopy (SLO A)

Chapter 9: Nuclear Magnetic Resonance and Mass Spectrometry (SLO A)

Chapter 11: Alcohols and Ethers (SLO D and E)

Chapter 12: Alcohols from Carbonyl compounds (SLO C and E)

Chapter 13: Conjugated Unsaturated Systems (SLO D and E)

Chapter 14: Aromatic Compounds (SLO B and E)

Chapter 15: Reactions of Aromatic Compounds (SLO B, D and E)

Chapter 16: Aldehydes and Ketones I: Nucleophilic Addition to the Carbonyl Group (SLO C and E)

Chapter 17: Aldehydes and Ketones II: "Enols and Enolates (SLO C and E)

Chapter 18: Carboxylic Acids and their Derivatives (SLO C and E)

Chapter 19: Synthesis and Reactions of β -Dicarbonyl Compounds (SLO C, D and E)

Chapter 20: Amines (SLO C and E)

Chapter 21: Phenols and Aryl Halides: Nucleophilic Aromatic Substitution (SLO C, D and E)

Homework: There will be problems assigned for each chapter. **NO LATE HOMEWORK WILL BE ACCEPTED.**

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.** You may drop one laboratory report during the semester. Any additional missed laboratories will count as a *zero*.

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 (15%): 45%

Final Exam: 20%

Laboratory: 20%

Midterm Exam I: Wednesday, February 18th

Midterm Exam II: Friday, March 13th

Midterm Exam III: Wednesday, April 15th

Final Exam: Wednesday, May 13th

Course Calendar

Lecture 1 (January 21): Discussion on Syllabus, IR Spectroscopy

Lecture 2 (January 23): NMR Spectroscopy

Lecture 3 (January 26): NMR and Mass Spectroscopy (MS)

Lecture 4 (January 28): Revision on Chapters 2 (IR) and 9 (NMR and MS)

Lecture 5 (January 30): Structure and nomenclature of alcohols, general physical and chemical properties of alcohols (**Homework 1 due**)

Lecture 6 (February 02): Reactions of alcohols, overview of reactions of carbonyl compounds with nucleophiles

Lecture 7 (February 04): Revision of Chapter 11

Lecture 8 (February 06): Preparation of alcohols from carbonyl compounds, oxidation of alcohols (**Homework 2 due**)

Lecture 9 (February 9): Reaction of organolithium and organomagnesium compounds + revision on Chapter 12

Lecture 10 (February 11): Allylic substitution reactions, 1, 3-butadiene and stability of conjugated dienes (**Homework 3 due**)

Lecture 11 (February 13): 1,4 addition on conjugated dienes, Diels-Alder reaction + Revision on Chapter 13

Lecture 12 (February 16): Exam revision on Chapters 2, 9, 11 & 12 (**Homework 4 due**)

Lecture 13 (February 18): Exam I (Chapters 2, 9, 11 & 12)

Lecture 14 (February 20): Review on aromatic compounds. Nomenclature of benzene derivatives, differences between alkenes and benzenes compounds in terms of general reactions

Lecture 15 (February 23): Stability of benzene

Lecture 16 (February 25): Revision on Chapter 14

Lecture 17 (February 27): Electrophilic aromatic substitution reactions (**Homework 5 due**)

Lecture 18 (March 02): Friedel-Crafts alkylation/acylation, effect of substituents on reactivity and orientation, synthetic applications

Lecture 19 (March 04): Revision on Chapter 15 (**Homework 6 due**)

Lecture 20 (March 06): Nomenclature of aldehydes and ketones, synthesis of aldehydes and ketones, nucleophilic addition to the carbon-oxygen double bond

Lecture 21 (March 9): Synthesis of hemiacetals and acetals, addition of primary and secondary amines to carbonyl groups, Wittig reaction

Lecture 22 (March 11): Exam revision on Chapters 13, 14, 15 and 16 (**Homework 7 due**)

Lecture 23 (March 13): Exam II (Chapters 13, 14, 15 & 16)

March 16-20th is Spring Break (No classes)

Lecture 24 (March 23): Reactions via enols and enolate anions

Lecture 25 (March 25): Reactions via enols and enolate anions continues, aldol reactions

Lecture 26 (March 27): Aldol condensations continue, addition to unsaturated aldehydes and ketones

Lecture 27 (March 30): Review on Chapter 17 (**Homework 8 due**)

Lecture 28 (April 01): Nomenclature and physical properties of carboxylic acids and acid derivatives, preparation of carboxylic acids

Lecture 29 (April 03): Synthesis and reactions of esters and amides

Lecture 30 (April 06): Decarboxylation of carboxylic acids, summary of the reactions of carboxylic acids and their derivatives

Lecture 31 (April 08): Review on Chapter 18 (**Homework 9 due**)

Lecture 32 (April 10): Claisen condensation reactions, Dieckmann condensation reactions, acetoacetic ester synthesis

Lecture 33 (April 13): Exam revision on Chapters 17-18

Lecture 34 (April 15): Exam III; Chapters 17-18

Lecture 35 (April 17): Synthesis of substituted acetic acids, Michael additions, summary of important reaction of dicarbonyl compounds

Lecture 36 (April 20): Revision on Chapter 19 (**Homework 10 due**)

Lecture 37 (April 22): Nomenclature and physical properties of amines, basicity of amines, amines vs. amides, preparation of amines

Lecture 38 (April 24): Reactions of amines

Lecture 39 (April 27): Revision on Chapter 20 (**Homework 11 due**)

Lecture 40 (April 29): Structure and nomenclature of phenols, physical properties and synthesis of phenols

Lecture 41 (May 01): Reactions of phenols + Revision on Chapter 21

Lecture 42 (May 04): Final Exam Revision (Chapters 2, 9, 11, 12, 13, 14, 15) (**Homework 12 due**)

Lecture 43 (May 06): Final Exam Revision (Chapters 16, 17, 18, 19, 20, 21)

Final Exam (May 13): At 8:00 am-10:00 am; Chapters 2,9, 11-21

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 Schwartze, 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.