

**Sul Ross State University**  
**Syllabus for CHEM 3408 (Spring 2016)**

**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

***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 T. W. Solomons, C. B. Fryle and S.A. Snyder (11th ed.), **2014**, John Wiley & Sons (older editions are ok); **Lab Manual:** "Techniques and Experiments for Organic Chemistry" (6<sup>th</sup> Edition) by A. Ault, **1998**, University Science Books; Molecular Model Set (Recommended.....even soft jelly candy with toothpicks can work!)

The following chapters will be covered:

**Chapter 2.15:** Infrared Spectroscopy (SLO A)

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

**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: Nucleophilic Addition to the Carbonyl Group  
(SLO C and E)

**Chapter 17:** Carboxylic Acids and their Derivatives (SLO C and E)

**Chapter 18:** Reactions at the  $\alpha$  Carbon of Carbonyl Compounds: Enols and Enolates (SLO C  
and E)

**Chapter 19:** Condensation and Conjugate Addition Reactions of Carbonyl 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.**

**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 24<sup>th</sup>  
**Midterm Exam II:** Wednesday, March 30<sup>th</sup>  
**Midterm Exam III:** Wednesday, April 27<sup>th</sup>  
**Final Exam:** Wednesday, May 11<sup>th</sup> at 8:00 am

### Course Calendar

**Lecture 1 (January 20):** Discussion on Syllabus, IR Spectroscopy

**Lecture 2 (January 22):** IR Spectroscopy & NMR Spectroscopy

**Lecture 3 (January 25):** NMR Spectroscopy

**Lecture 4 (January 27):** Mass Spectroscopy (MS) & revision on IR, NMR and MS

**Lecture 5 (January 29):** Preparation of alcohols from carbonyl compounds, oxidation of alcohols (**Homework 1 due**)

**Lecture 6 (February 1):** Reaction of organolithium and organomagnesium compounds + revision on Chapter 12

**Lecture 7 (February 3):** Allylic substitution reactions, 1, 3-butadiene and stability of conjugated dienes (**Homework 2 due**)

**Lecture 8 (February 5):** 1,4 addition on conjugated dienes, Diels-Alder reaction

**Lecture 9 (February 8):** Revision on Chapter 13; Review on aromatic compounds. Nomenclature of benzene derivatives,

**Lecture 10 (February 10):** Differences between alkenes and benzenes compounds in terms of general reactions (**Homework 3 due**)

**Lecture 11 (February 12):** Stability of benzene; Revision on Chapter 14

**Lecture 12 (February 15):** Electrophilic aromatic substitution reactions (**Homework 4 due**)

**Lecture 13 (February 17):** Friedel-Crafts alkylation/acylation,

**Lecture 14 (February 19):** Effect of substituents on reactivity and orientation, synthetic applications; Exam Revision on Chapters 2 & 9

**Lecture 15 (February 22):** Exam revision on Chapters 12-14

**Lecture 16 (February 24):** Exam I (Chapters 2, 9, 12-14)

**Lecture 17 (February 26):** Revision on Chapter 15

**Lecture 18 (February 29):** Nomenclature of aldehydes and ketones, synthesis of aldehydes and ketones, nucleophilic addition to the carbon-oxygen double bond (**Homework 5 due**)

**Lecture 19 (March 2):** Synthesis of hemiacetals and acetals, addition of primary and secondary amines to carbonyl groups

**Lecture 20 (March 4):** Wittig reaction; Revision on Chapter 16

**Lecture 21 (March 7):** Nomenclature and physical properties of carboxylic acids and acid derivatives, preparation of carboxylic acids (**Homework 6 due**)

**Lecture 22 (March 9):** Synthesis and reactions of esters and amides

**Lecture 23 (March 11):** Decarboxylation of carboxylic acids, summary of the reactions of carboxylic acids and their derivatives

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

**Lecture 24 (March 21):** Review on Chapter 17 (**Homework 7 due**)

**Lecture 25 (March 23):** Reactions via enols and enolate anions

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

**Lecture 26 (March 28): Exam revision on Chapters 15-17**

**Lecture 27 (March 30): Exam II (Chapters 15-17)**

**Lecture 28 (April 1):** Acetoacetic and Malonic Ester syntheses; Enamine chemistry

**Lecture 29 (April 4):** Review on Chapter 18

**Lecture 30 (April 6):** Claisen & Dieckmann condensation reactions (**Homework 8 due**)

**Lecture 31 (April 8):** Aldol condensations continue; addition to unsaturated aldehydes and ketones

**Lecture 32 (April 11):** Synthesis of substituted acetic acids, Michael additions, summary of important reaction of dicarbonyl compounds

**Lecture 33 (April 13):** Revision on Chapter 19

**Lecture 34 (April 15):** Nomenclature and physical properties of amines, basicity of amines, amines vs. amides, preparation of amines (**Homework 9 due**)

**Lecture 35 (April 18):** Reactions of amines

**Lecture 36 (April 20):** Revision on Chapter 20

**Lecture 37 (April 22):** Structure and nomenclature of phenols, physical properties and synthesis of phenols (**Homework 10 due**)

**Lecture 38 (April 25): Exam revision on Chapters 18-20**

**Lecture 39 (April 27): Exam III: Chapters 18-20**

**Lecture 40 (April 29):** Reactions of phenols, revision on Chapter 21; Exam Revision Chapter 2 & 9

**Lecture 41 (May 2): Final Exam Revision (Chapters 12-15) (Homework 11 due)**

**Lecture 42 (May 4): Final Exam Revision (Chapters 16-19)**

**Final Exam (May 11): At 8:00 am-10:00 am; Chapters 2,9, 12-21**

**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. 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 or david.leaver@sulross.edu. Homework electronically completed in Microsoft Word or other similar programs will NOT be accepted.*