Class Times:  Class will meet on Zoom at the scheduled time (8:00-10:45 am TR)
Zoom links will be posted on D2L

Instructor:  Russell J. Franks, Ph.D.

Office:  M-114  Email:  rjfranks@sfasu.edu  Phone:  (936) 468—2199

I will not be doing in-person office hours this semester.
I am happy to help you by other means including:

- via email
- via Zoom during the scheduled class periods
- via an individual Zoom meeting (please email me to arrange a meeting)

Catalog Description:
Topics may include recent developments in organic synthesis, organometallics, heterocyclics, phase transfer catalysis, and physical organic chemistry. May be repeated under different topics.

Prerequisites:
A grade of C in CHE 332 (or its equivalent)

Co-requisites:
None

Required Texts and Other Materials:
- You also should have access to an undergraduate organic text (Wade, Brown, etc.).

Required Supplementary Readings:
Handouts and supplementary readings from the chemical literature will posted on D2L. You are expected to download these files and read them thoroughly

Student Learning Outcomes:  Upon completion of CHEM 5311, students will be able to:
- Describe the basic instrumental principles involved in the operation of mass spectrometers, infrared spectrometers, and nuclear magnetic resonance spectrometers. This includes methods of sample handling and preparation, signal generation and detection, and data analysis for each method.
- Describe the physical and chemical principles that occur at the molecular level during a MS, IR, or NMR experiment.
- Analyze MS, IR, and/or NMR spectral data (either alone or in combination) to elucidate the structure of an organic molecule. This includes being able to make correlations of spectral features to specific portions of a molecule’s structure.

Course Overview:
This is a course in Organic Spectroscopy. Spectroscopy is presented in undergraduate organic classes, but students only see the proverbial “tip of the iceberg” in their undergraduate classes. This course is intended to give students a more complete picture of how spectroscopic methods are used to elucidate the structure of complex organic molecules. Among the topics that will be covered will be:

- A more detailed discussion of the nuclear magnetic resonance phenomenon at the molecular level
- A variety of NMR spectroscopic methods will be discussed including more detailed treatments of basic $^1$H-NMR and $^{13}$C-NMR spectroscopy, as well as other techniques, e.g. DEPT, COSY, TOCSY, HETCOR, HMQC, HSQC, HMBC, NOESY, ROESY, and other more complex techniques. NMR spectroscopy of other common NMR-active nuclei (e.g. $^{19}$F & $^{31}$P) will also be discussed.
- You will be required to learn how to process NMR spectra (1D & 2D) using the SpinWorks program
- A much more detailed discussion of mass spectrometric methods will be presented. This includes discussion of various ionization and mass filter methods. In addition, treatment of high-resolution MS data and fragmentation pattern analysis will also be discussed in depth.
- Vibrational spectroscopy techniques including IR and Raman spectroscopy.
- In addition, students will be given ample practice in the use of these spectroscopic techniques in determining the structure of complex organic molecules.
Course Requirements:

Homework:

- Homework will be assigned weekly throughout the semester
- Problems will come from the text and from other sources
- Problem sets are due on the specified due date & time.
- You may turn your homework in using a couple of different methods:
  a) You may scan your homework assignment and email it to me as a pdf file
  b) You may staple your homework assignment and slide it under my door
  c) Whichever way you choose to turn in your homework is fine with me. I don’t care if you turn one assignment in scanned/emailed and turn in the next assignment in hard-copy format.
  d) The important thing is that you turn in your homework on time.
  e) The next, but equally important thing is that your first & last names should be clearly written on the first page.
- All work submitted should be neat, orderly, and logical. Take the time to draw structures neatly. To receive full credit, I should be able to see how you worked the problem AND the thinking and rationale that you used to solve the problem.
- I don’t mind if you collaborate with your classmates on the problem sets. In fact, I encourage you to collaborate with your classmates. You can learn a lot this way. However, I do expect that you have worked and understand all of the problems in a problem set. If you let others do your work for you, you'll regret it on the CoLs.
- If a problem gives a literature reference, I don’t mind that you look up the reference. Again, I would encourage you to do so. Please keep in mind that even though you might find the “answer” to a problem in the literature, I still expect that you understand (and be able to discuss thoroughly & in depth) the problem and the “answer”.

Celebrations of Learning (CoLs):

- Two CoLs will be given on the dates listed in the table below.
- CoLs will be given in the evening, and will be done in-person. Face coverings are required to be worn during CoLs and social distancing must be maintained.
- Material for CoLs will come from: assigned readings, lecture notes, and problem sets. Any material from these is considered “fair game” for CoLs.
- You may use calculators, but not other electronic devices on CoLs. **Usage of any electronic device during an CoL will be treated as ACADEMIC MISCONDUCT.**
- **Please note:** In order for you to have enough time to complete CoLs, all CoLs (except for the final) will be given at night. **It is your responsibility to make any needed adjustments in your class/work/extracurricular schedule to accommodate for this.** Please keep in mind that three hours are allotted for the CoLs for a reason. You should expect CoLs that are thorough and challenging. Plan to stay for the entire three-hour period.

Final CoL:

- The final CoL for this course will be given at a mutually agreed upon date, time, and place during finals week.
- The final CoL will NOT be comprehensive, but will cover material discussed after CoL 2
- You MUST take the final CoL in order to pass the class. If you do not take the final, you will be assigned a grade of F in the course, regardless of your standing in the class prior to the final CoL.

Method of Evaluation:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date</th>
<th>Percentage of Semester Grade</th>
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<tbody>
<tr>
<td>CoL 1</td>
<td>Thurs., Sept. 10th (time TBA)</td>
<td>20 %</td>
</tr>
<tr>
<td>CoL 2</td>
<td>Thurs., Oct. 1st (time TBA)</td>
<td>20 %</td>
</tr>
<tr>
<td>Final CoL</td>
<td>Thurs., Oct. 15th (time TBA)</td>
<td>20 %</td>
</tr>
<tr>
<td>Homework</td>
<td>Assigned throughout the semester</td>
<td>40 %</td>
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</tbody>
</table>

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<tr>
<th>Letter Grade</th>
<th>Approximate Percentages</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>85—100 %</td>
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<tr>
<td>B</td>
<td>70—84 %</td>
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<tr>
<td>C</td>
<td>60—69 %</td>
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<tr>
<td>D</td>
<td>50—59 %</td>
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<tr>
<td>F</td>
<td>0—49 %</td>
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</tbody>
</table>
Please take note of the following:

- You are adults and I will treat you like adults. This course and what you do in it is 100% your responsibility. It is your responsibility to come to class, read the assigned sections in the text before class, take good notes in class, do the homework, and get help if you are having trouble. I am more than willing to help you if you have trouble, but YOU need to take the initiative to seek help.
- Grades will NOT be “curved” in this course. If you aspire to make a certain grade, please make sure that you have acquired the minimum number of points for that grade by the end of the semester.
- Any material covered in lecture notes, problem sets, and/or assigned readings is “fair game” for CoLs. You are expected to learn, understand, and MASTER the material.

Make-up Policy:
If you miss a CoL, it is your responsibility to contact me within 24 hours of the CoL date. If you are physically unable to contact me, have a friend or family member contact me. You may do this by calling my office and leaving a voicemail, sending me an email, or calling the Chemistry Dept. office (936-468-3606) and leaving a message. Make-up CoLs will only be allowed when an absence is documented and verified as being excused under the provisions of the SFA Policies and Procedures Manual. Make-up CoLs will be given during “dead week”. I reserve the right to give a comprehensive CoL for a make-up CoL.

Attendance Policy:
- This is a graduate class. You are expected to be in class FOR EVERY CLASS MEETING. Period.
- If you should need to be absent for an extended period, or if there are extenuating circumstances regarding attendance, please inform me as soon as possible.
- Class will begin promptly at 8:00 am. You should be logged into Zoom and ready to begin when I start.

Academic Integrity Policy:
All students are urged to acquaint themselves with the University's codes, policies, and procedures involving academic misconduct, grievances, sexual and ethnic harassment, and discrimination based on disability. Copies of the SFA Policies and Procedures Manual can be obtained in print or online from the Office of Academic Affairs (http://www.sfasu.edu/upp/pap/academic_affairs.html).

Students engaging in any type of academic misconduct (including, but not limited to: cheating, plagiarism, or any other action that can improperly affect my evaluation of your performance) will be subject to sanctions in accordance with SFA Academic Integrity Policies. I will recommend a grade of "F" for the course and expulsion from the graduate program and University for any such violations.

Semester Withdrawals:
Please note: The last day to drop this course without receiving a WP or WF on your transcript is Thursday, Sept. 24th.
Academic Disabilities Policy:

Stephen F. Austin State University is committed to providing reasonable accommodations for all students with disabilities. Students with disabilities who require accommodations in this course are requested to speak with me as early in the semester as possible. Students with disabilities must be registered with the Office of Disability Services prior to receiving accommodations in this course. The Office of Disability Services is located in the Human Services Bldg., Room 325, (936) 468-3004 or (936) 468-1004 (TDD).

Classroom Policies & Other Things to Note:

- As SFA, and many other universities, learned during the Spring 2020 COVID crisis, some individuals engaged in “zoombombing” during Zoom meetings in which individuals yelled inappropriate things or displayed obscene images, etc.
- Our Zoom class meetings are to be treated as though we were in a face-to-face classroom.
- Individuals who engage in any form of inappropriate behavior can be subject to disciplinary action from the university. Frankly, this course is challenging enough that you shouldn’t have time to engage in any of that sort of tomfoolery.
- The COVID pandemic, and the academic problems associated therewith, that we all experienced in the Spring 2020 semester were hard on all of us.
- Unfortunately, nobody knows when the situation is likely to get better. I think we all hope that this will happen soon, but nobody knows when that is likely to be.
- The COVID crisis also has placed a lot of strain on many other aspects of society.
- One thing that I found during the spring is that communication is of the utmost importance. Stuff happens and, unfortunately, it’s not always good stuff that happens.
- I would ask that you maintain good communication with me this semester. If you, or someone around you, tests positive for COVID, or becomes ill with COVID, please let me know as soon as possible. If you are having trouble academically, please let me know. I’m not a counselor, but I am not bereft of compassion either. I will do what I can to help you get through these tough times, but I can’t help you if I don’t know that you are struggling. I’ll be honest with you, I have also struggled at maintaining my own personal motivation and morale during the past several months. I can relate probably a lot more than you realize.
- I am required by the university to include a statement on masks and social distancing.
- Since we are not ever going to meet face-to-face as a class, these don’t really apply. You are not required to wear a mask during our Zoom class meetings unless you feel the need to or if you are in a place in which wearing a mask is required.
- If you are on the SFA campus, then you are expected to follow the SFA guidelines on wearing facial coverings and social distancing. If you don’t, you can get into trouble from the university.
- As for me, I will not be wearing a mask during our Zoom classes because I’ll be safely in my office. When I leave my office, I do wear a mask. I also wear a mask when I go out in public to Kroger and Wal-Mart and what not. I don’t like wearing a mask because it fogs up my glasses, but I do it anyway for my own safety and the safety of others with whom I come into contact.
- I’ll add this about wearing masks and other COVID-related precautions: It’s a shame that COVID precautions have become a political issue in the US, but they certainly have. I can tell you this much. I have a lot of former students from SFA and from when I taught at OU who are doctors, nurses, dentists, pharmacists, veterinarians, and other medical professionals. I keep up with them on Facebook and Instagram. These folks cover a wide range of political beliefs and values. Some are liberal, some are conservative, and some are moderate. Despite this, these folks are ALL strong advocates of wearing masks and taking reasonable COVID precautions. As far as I’m concerned, if these folks are in favor of masks, then that’s good enough for me. That’s all that I’ll say about the issue:)

I reserve the right to change any items contained in this syllabus. This includes, but is not limited to: course content, scheduled dates, grade cutoffs, and fraction(s) of final grade assigned to individual components of the course. If I need to make such changes, I will inform you of the changes in writing. This syllabus in no way constitutes a legally-binding contract on my part.
<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Possible Topic(s)</th>
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| 08/25 | T   | • Introduction; Syllabus & Policies; Course Overview  
• Molecular formula determination methods; IR Spectroscopy                                                                |
| 08/27 | R   | • IR Spectroscopy  
• Mass Spectrometry; Introduction; Ionization, mass filter, & detection methods                                                                 |
| 09/01 | T   | • Mass Spectrometry; Fragmentation analysis                                                                                                        |
| 09/03 | R   | • Mass Spectrometry; Fragmentation analysis                                                                                                        |
| 09/08 | T   | • NMR Spectroscopy; Basic principles; Anatomy of an FTNMR; The FTNMR process  
• $^1$H-NMR: Proton equivalence & spectral integration                                                  |
| 09/10 | R   | • Use of SpinWorks to process $^1$H-NMR spectra  
• Review for CoL #1                                                                                                                                     |
| 09/10 | R   | CoL #1 (Time & Place TBA)                                                                                                                          |
| 09/15 | T   | • $^1$H-NMR: Chemical shift; Methods for estimating $^1$H-NMR chemical shift values  
• $^{13}$C-NMR Spectroscopy; Basic principles; Similarities & differences to $^1$H-NMR                                          |
| 09/17 | R   | • $^{13}$C-NMR Spectroscopy; Chemical shift in $^{13}$C spectra; estimating $^{13}$C chemical shift values  
• Use of SpinWorks to process $^{13}$C-NMR spectra                                                                 |
| 09/22 | T   | • NOE & relaxation processes; Polarization transfer mechanisms  
• The DEPT experiment & its use in structural elucidation; SpinWorks & DEPT                                                                        |
| 09/24 | R   | • Simple & complex spin coupling; Chemical equivalence vs. magnetic equivalence  
• Proton exchange, NMR spectra of chiral species, 1D-NOE spectra                                                                                   |
| 09/29 | T   | • Intro to multiple-pulse & 2D NMR experiments; COSY, TOCSY, & HETCOR spectra  
• Use of SpinWorks to process 2D spectra                                                                                                           |
| 10/01 | R   | • Inverse detection methods: HMQC, HSQC, & HMBC  
• Review for CoL #2                                                                                                                                       |
| 10/01 | R   | CoL #2 (Time & Place TBA)                                                                                                                          |
| 10/06 | T   | • Analysis of HSQC/HMQC/HMBC spectra                                                                                                               |
| 10/08 | R   | • NOE-based experiments, NOESY & ROESY; Multinuclear NMR ($^{19}$F-NMR & $^{31}$P-NMR)                                                                 |
| 10/13 | T   | • Practice in structural elucidation  
• Review for CoL #1                                                                                                                                       |
| 10/15 | R   | Final CoL (Time & Place TBA)                                                                                                                       |