

## CHMD11HF- Application of Spectroscopy in Structure Determination

### Lectures:

Mondays 10:00 am to 12:00 pm (HL B106)  
Friday 10:00 am to 11:00 am (HL B106)

All lectures will be conducted in person. However, ZOOM maybe used due to unforeseen circumstances.

### Technical Requirements:



Stable internet connection



Laptop or computer



Working microphone



Working webcam

### Instructor:

Ronald Soong PhD  
e-mail: [ronald.soong@utoronto.ca](mailto:ronald.soong@utoronto.ca)  
Office: SY205B

### Course Description:

Students will learn about the following analytical techniques used in organic structure determination: mass spectrometry, IR spectroscopy, NMR spectroscopy, and ultraviolet-visible spectroscopy. The students will learn a systematic approach in structure determination through various spectroscopy. Student will receive hands-on training in spectral interpretation, processing and analysis as well as training on the use of different computer software for the purpose of analysis.

### Required Prerequisites:

*Prerequisite:* CHMB16H3 and CHMC11H3  
*Recommended Preparation:* CHMC16

### Grading Scheme:

Tests/Assignments	% Final Grade
MidTerm (Oct 31 <sup>st</sup> , 2022)	20
Assignment	20
Proposal Presentation	10
Final Project Report	10
Final Project Presentation	10
Special Essay Topic	30

## **General Course Goals and Objectives:**

### **Rational:**

This course aims to expand on the basic scientific principles behind structure determination in organic chemistry. Although many students understand certain aspects of chemical structure elucidation, a full systematic treatment of such a topic is required for a full comprehension on the subject matter. The classes will provide students a weekly opportunity to develop the analytical skills required to quickly and accurately evaluate spectral data from UV, IR, NMR and MS. In addition, the student will learn to properly organized and present spectral data.

### **Learning Outcomes:**

Students who completed this course will gain: 1) an in-depth understanding of chemical structural determination, 2) experience with problem solving and development of literature research skills, hands-on experience with spectral analysis, 3) development of oral and written communication skills through preparation of assignments and projects. This course will also expose students to at least 2 scientists who are working in the industry. The instructor of this course will also provide students with information about career opportunities after graduation as well as graduate school options

### **Teaching Methods:**

This course is composed of a lecture, laboratory and research components. The lecture component will introduce an array of analytical tools, the working principle behind these tools, and which tool is most appropriate for a particular organic structure. The laboratory component provides students the opportunity to apply the theory learned in class to practice. A few of the lectures will be devoted to class research projects, where students will have the opportunity to discuss their findings.

## **Description of Assignments and Tests:**

### **Late Term Work Policy:**

**Late term work will not be accepted.** Students will receive a zero (0%) for any work (labs and assignments) not turned in on the due date without medical or other acceptable documentation. Students must complete a Student Declaration of Absence form (available through ACORN) if they are ill and cannot submit a lab or assignment.

### **Policy on Missed Term Work:**

Students must complete a Student Declaration of Absence form (available through ACORN) if they are ill and cannot submit an assignment or lab. **There is no opportunity to make up a lab.** In the absence of a justified reason (e.g., illness or agreed upon absences) then a mark of 0% will be applied to that lab or assignment. Otherwise, weighting of that course work will be added to the weighting of the final exam.

### **Final Grades:**

Final grades will be calculated according to the weights listed in the Grading Scheme. There will be **no additional assignments** available for students to increase their grade or substitute for a

certain assignment or test grade. Final grades will be submitted to the university in terms of percentages. For breakdown of percentages into letter grades, GPA, and grade definitions go to: <http://www.artsci.utoronto.ca/newstudents/transition/academic/grading>

### **Course Policies:**

#### **Expectations for Conduct in the Academic Setting:**

I view the classroom relationship as an academic dialogue. It is my personal goal that we can all approach our relationship as students, faculty, and TAs with a spirit of honesty, fairness, and mutual respect for each other and for learning. That is the atmosphere I try to promote.

My expectation of you is that you will respect to me, my TAs, other faculty, staff, and fellow students. This includes the following:

- Arriving on time for class and staying for the entire class (to minimize disruptions)
- Listen quietly (to minimize disruptions)
- Approach your course work with an open, honest spirit, and enthusiasm

In turn, you can expect me and my TA's to show respect to you and your fellow students in the following manner:

- Deliver the best course possible
- Communicate our enthusiasm for the material
- Maintain fairness in all aspect of course delivery and assessment

### **Equity & Diversity:**

The University of Toronto is committed to equity and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect. As a course instructor, I will neither condone nor tolerate behaviour that undermines the dignity or self-esteem of any individual in this course and wish to be alerted to any attempt to create an intimidating or hostile environment. It is our collective responsibility to create a space that is inclusive and welcomes discussion. Discrimination, harassment and hate speech will not be tolerated.

### **Student Participation Policy:**

During class discussions students will be expected to participate in group work and be prepared to present in of the class. Topics discussed during class will expand on the lectures and aim to enhance critical thinking skills and will consist of examinable material.

### **Quercus:**

I will make use of Quercus to communicate with you about the course, so you should make a habit of routinely checking your Quercus account. Important announcements will generally be delivered to your UTORmail+ inbox in addition to being posted on Quercus. You will also find course materials posted to the website, such as the syllabus, lecture materials, and assignments.

The Technology Centre in the Hazel McCallion Academic learning Centre provides support and instruction regarding the use of Quercus should students have any further questions.

### **Electronic Communication:**

Email communication is rapid, convenient, and efficient—and you are encouraged to use it to enhance your learning and experience in the course. With that said, it is essential that you follow a few rules:

- All course communication should be conducted through Quercus or your utoronto account.
- All emails must include the course code (e.g., CHMD11) in the subject line.
- All emails should be signed with the student’s full name and student number.
- Emails from students will generally be answered within 48 hours of receipt.
- Treat emails as you would any other professional communication. Proofread. Use appropriate language.
- Emails that ask questions that are answered in the course syllabus or website (e.g., “how much is assignment X worth”) will not receive a response.

**Emails that do not follow these guidelines will not receive a response.**

### **Copyright on Instructional Settings:**

You must obtain written consent from the instructor for any recordings (tape or video) or photography in the lecture. Without consent any reproduction of lecture presentations, course notes or other similar materials provided by the instructor is an infringement of copyright and is absolutely prohibited. If any of these activities are required due to an accommodation then it must be arranged through the AccessAbility Resource Center.

### **Drop Policy:**

**November 22rd, 2021** is the last day to drop this course from academic record and GPA. By this time students will have written a midterm, completed two reflection assignments, and have had six labs graded and returned, 47.5% of their evaluative work will have been completed.

### **Academic Integrity:**

Copying, plagiarizing, falsifying medical certificates, or other forms of academic misconduct will not be tolerated. Any student caught engaging in such activities will be referred to the Dean’s office for adjudication and punishment. Any student abetting or otherwise assisting in such misconduct will also be subject to academic penalties.

- Students are expected to cite sources in all written work and presentations. (<http://www.writing.utoronto.ca/advice/using-sources/how-not-to-plagiarize>)
- By enrolling in this course, you agree to abide by the university’s rules regarding academic conduct, as outlined in the Calendar. You are expected to be familiar with the below policies which spell out your rights, your duties and provide all the details on grading regulations and academic offences at the University of Toronto.
  - Code of Behaviour on Academic Matters ([www.governingcouncil.utoronto.ca/policies/behaveac.htm](http://www.governingcouncil.utoronto.ca/policies/behaveac.htm))
  - Code of Student Conduct (<http://www.governingcouncil.utoronto.ca/policies/studentc.htm>)

### **Student Resources:**

**AccessAbility Policy:**

Students with diverse needs are welcome in this course. The UTSC *AccessAbility Resource Centre* offers services to assess specific student needs, provide referrals, and arrange appropriate accommodations. Students with questions about disability/health accommodations are encouraged to contact their instructor and/or the *AccessAbility Resource Centre* when the course begins. The *AccessAbility Resource Centre* staff can be contacted by phone (416-287-7560), email [ability@utsc.utoronto.ca](mailto:ability@utsc.utoronto.ca) or in person (Room SW302).

**Virtual Lecture Schedule for Fall 2021:**

<b>Week</b>	<b>Topic</b>	Additional Notes
<b>Sep 5</b>	Introduction / Group Setup	
<b>Sep 12</b>	<b>NMR</b>	<b>Group Setup Completed</b>
<b>Sep 29</b>	<b>NMR / NMR spectral Processing</b>	<b>Final Essay Topic chosen</b>
<b>Sep 26</b>	Basic 2D NMR spectroscopy	<b>Proposal Analysis Method Due</b>
<b>Oct 3</b>	UV-Vis/HPLC	<b>Proposal Cost Template Due</b>
<b>Oct 10</b>	Reading Week	<b>Final Essay Template Due</b>
<b>Oct 17</b>	MS & IR	<b>Assignment Handout</b>
<b>Oct 24</b>	Advance NMR spectroscopy & Basic of Structure Determination: Part 1	
<b>Oct 31</b>	Midterm / SOP	<b>Mid-Term</b>
<b>Nov 7</b>	Advance NMR spectroscopy & Basic of Structure Determination: Part 2	<b>Assignment Due</b>
<b>Nov 14</b>	Lab Demonstration/3D printing	
<b>Nov 21</b>	<b>Group Project Proposal Presentation &amp; TRACES</b>	<b>Final Proposal Due</b>
<b>Nov 28</b>	CryoEM Lab – DownTown MedSci & Guest Lecture	<b>Group Assignment Due</b>
<b>Dec 5</b>	<b>Final Project Presentation</b>	<b>Final Essay Due</b>

Marking Scheme Group Assignment - Proposal (10%)

Item	Grade
Group Setup – Identification of roles	1
Proposal Analysis Method with SOP	4
Proposal Cost Template	2
Final Proposal	3

Marking Scheme Final Essay (30%)

Item	Grade
Chosen Topic	5
Essay Template	5
List of Reference	5
Final Essay	15

Marking Scheme Final Group Assignment Report (10%)

Item	Grade
labeling of spectra	1
processing of spectra	1
Justification	2
Report	3
Certificate of Analysis	3