

**INSTRUMENTAL METHODS III: SPECTROSCOPY**  
CHEM 4190/6190 (CRN 82743/82745/94051)  
2020 Fall semester



**Instructors**

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**Course modality**      **This course is composed of lectures, which are online, and a laboratory component, which is face to face.**

**Lectures:** R 11:00 am – 12:40 pm (100 min.), via WebEx on iCollege. Each session is recorded and becomes automatically available to registered students on iCollege ~24 h after the lecture.

**Laboratory:** T 12:30 – 3:45 pm  
Refer to specific guidance from Dr. Chen on attendance and seating.

**Office Hours**      Individual consultation as requested. Email instructor to schedule.

**Prerequisites**      Grade C or above in CHEM 4000/6000 and CHEM4120/6120 or equivalent

**Recommended text**      *Principles of Instrumental Analysis* by Skoog, Holler and Crouch, 7<sup>th</sup> edition (2018), Cengage Learning, Independence, KY  
ISBN-13: 978-1-305-57721-3

### **Course Description**

Spectroscopy in all its forms is among the most powerful experimental techniques in chemical research. This course provides a theoretical foundation and hands-on opportunities for generate and analyze data from UV/visible absorption, fluorescence, FT-NMR, and FT-IR spectroscopy in probing physical properties of chemicals and their interactions. This course complements the Physical Chemistry sequence (CHEM 4110/4111/4120/4121), Introduction to Biophysical Chemistry (CHEM 4150) and Photon Science (CHEM 4470) by focusing on the instrumental, analytical, and experimental aspects of spectroscopic investigations into chemical systems.

### **Course Outcomes**

Upon completion of this course, students will be able to:

1. Describe the physical principles of spectroscopic detection by UV, visible, and IR absorption, fluorescence, NMR;
2. Demonstrate competency in operating contemporary spectroscopic instrumentation and analyzing their output;
3. Solve quantitative problems using spectroscopic data drawn from different techniques;
4. Write ACS-style laboratory reports.

### Critical Thinking/Problem Solving

- analyze visual data
- identify errors in reasoning
- connect valid research to support arguments/claims
- provide useful summaries/precis

### Digital Technology

- know and apply field-related technology to solve challenges
- use variety of modalities to express meaning
- create audience-appropriate layouts

### Professionalism/Work Ethic

- ask and respond appropriately to questions
- meet deadlines
- accept responsibility

### Teamwork/Collaboration

- collaborate in group projects
- prioritize tasks

### Additional course materials

Lecture slides, assignments, and additional handouts will be posted on the iCollege course page prior to the required dates. Dr. Chen will provide materials needed for the laboratory component.

### Attendance and participation policy

**You may access** any of the WebEx lectures in the semester **asynchronously** once they become available on iCollege after the session. **However, attendance at the live WebEx sessions is highly recommended** as participants benefit significantly through real-time discussions and clarifications with the instructor as the material is presented. Policy on the face-to-face laboratory component will be elaborated by Dr. Chen.

### Grading and assessments

Take-home assignments/open-book examinations	4 × 17.5% =	70%
Lab reports, lab preparation, and notebook		30%

Please refer to the laboratory syllabus (a separate document from the laboratory Instructor) for specific guidance on the laboratory assessments. Graduate students enrolled in CHEM 6190 have additional laboratory requirements over undergraduates enrolled in CHEM 4190.

Students can be assured of the following grades by attaining the following scores:

94%	<b>A+</b>	84%	<b>B+</b>	74%	<b>C+</b>	60%	<b>D</b>
90%	<b>A</b>	80%	<b>B</b>	70%	<b>C</b>	Below 50%	<b>F</b>
87%	<b>A-</b>	77%	<b>B-</b>	67%	<b>C-</b>		

### Make-up policy

Each assignment/exam will explicitly show its due date. Since there will be ample time to complete the work, you are expected to submit the work on time. If circumstances emerge will cause excessive hardship in a timely submission, you must notify the instructor at least 48 h prior to the

due date. Any accommodation is strictly as agreed upon by the instructor and will be documented. Student requiring accommodation for disability should consult the statement of student support below.

### **Academic honesty**

The Department of Chemistry follows the University policy on academic honesty published in the “Student Code of Conduct” (<https://codeofconduct.gsu.edu/>). All assignments and tests taken must represent the student’s individual, unaided effort. Receiving or offering information on a test or assignment is cheating, including digital social media (e.g., Facebook groups, GroupMe, Chegg), as is the use of unauthorized supplementary materials or devices. **To receive credit, each assignment/exam must be accompanied by its coversheet, which the submitting student must sign to acknowledge that she/he understands the GSU policy on academic integrity and intends to follow it. Any suspected offense may be referred to the Dean of Students for further action.** The consequences of cheating are severe and potentially long-lasting: don’t do it!

### **Statement of student support**

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. Students who wish to request accommodation for a disability may do so via the Access and Accommodations Center (AACE) at <https://access.gsu.edu/>. Students may only be accommodated upon issuance of a signed Accommodation Plan by the AACE Center (see: <https://access.gsu.edu/testing-services/>) and are responsible for providing a copy of that plan to instructors of all classes in which accommodations are sought.

### **FERPA**

In keeping with USG and university policy, this course will make every effort to maintain the privacy and accuracy of your personal information. Specifically, unless otherwise noted, it will not actively share personal information gathered from the site with anyone except university employees whose responsibilities require access to said records. However, some information collected from the site may be subject to the Georgia Open Records Act. This means that while we do not actively share information, in some cases we may be compelled by law to release information gathered from the site. Also, the site will be managed in compliance with the Family Educational Rights and Privacy Act (FERPA), which prohibits the release of education records without student permission.

### **Sexual harassment**

In instances of sexual misconduct, the present instructor(s) and teaching assistants, are designated as Responsible Employees who are required to share with administrative officials all reports of sexual misconduct for university review. If you wish to disclose an incident of sexual misconduct confidentially, there are options on campus for you do so. For more information on this policy, please refer to the Sexual Misconduct Policy which is included in the Georgia State University Student Code of Conduct.

**Basic needs statement**

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. Furthermore, please notify the professor if you are comfortable in doing so. This will enable us to provide resources that we may possess. The Embark program at GSU provides resources for students facing homelessness.

**Course evaluation**

Your constructive assessment of this course plays an indispensable role in shaping education at Georgia State. Upon completing the course, please take time to fill out the online course evaluation.

## Course Schedule

The course syllabus provides a general plan for the course; deviations may be necessary.

Week	Date	Topic	Chapter*
1	08/27	Orientation and introduction	6
2	09/03	Particle and wave properties of light	
3	09/10	Light absorption: theory	8,16
4	09/17	Assignment/test 1	
5	09/24	Absorption spectroscopy: instrumentation	7
6	10/01	Absorption spectroscopy: chemical properties	13, 14, 17
7	10/08	Absorption spectroscopy: applications	
8	10/15	Assignment/test 2	
9	10/22	Fluorescence: theory and instrumentation	15
10	10/29	Fluorescence: applications	
11	11/05	Assignment/test 3	
12	11/12	Nuclear magnetic resonance (NMR)	
13	11/19		
14	11/26		Thanksgiving: no classes
15	12/03	Assignment/test 4	19

The University requires that faculty members must, on a date after the midpoint of the course to be set by the Provost (or her designee) give a W to all students who are on their rolls but are no longer taking the class and report the last day the student attended or turned in an assignment. Students who are withdrawn may petition the Departmental Chair for reinstatement into their classes. **For the Fall 2020 semester, the semester midpoint is 10/13/2020.**

\* From Skoog et al.