

## Syllabus, CHEM/BCMB 4190/6190/8189

### Introductory NMR / Fundamentals of NMR

Nuclear Magnetic Resonance (NMR) is a type of spectroscopy that uses the magnetic properties of nuclei to probe molecular structure and dynamics. It has applications in analysis of organic and inorganic compounds, in structure determination of biological macromolecules, and even in medical imaging. These introductory courses are intended to serve a broad audience seeking background in principles behind NMR methodology and practical knowledge of data acquisition and analysis. Material is presented in both lecture and laboratory formats. It is an ideal stepping-stone to more advanced courses offered in biomolecular NMR (CHEM/BCMB 8190) as well as other application-oriented courses.

The three courses share lecture and laboratory presentations. Grading is based on exams, written laboratory reports, and an evaluation of classroom and laboratory participation (see page 3 of this syllabus). For 8189 completion of an additional independent study project is required.

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**Office Hours:** - any time / by appointment

**Course Website:** - <http://www.bmb.uga.edu/bcmb4190>

**Class time:** - Tu,Th, 3:30-4:45

**Recommended text:** - Friebolin "Basic One and 2D NMR Spectroscopy" – VCH paperback  
- 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> or 5<sup>th</sup> edition

#### Course Outline and Dates:

Month	Day	Date	Lecture / Exam / Lab	Readings
<b>August</b>				
	Tu	19	Introduction	
	R	21	Basic principles I	1.1 - 1.5
	Tu	26	Basic principles I, II	1.1 - 1.5
	R	28	Basic principles II	1.1 - 1.5
<b>September</b>				
	Tu	2	Data Acquisition	1.5
	R	4	Chemical Shifts	1.6, 2.1 - 2.5, 6.1 - 6.4
	M,Tu,W	8,9,10	1D, <sup>1</sup> H NMR Lab #1	
<b>EXAM</b>	<b>R</b>	<b>11</b>	<b>EXAM 1</b>	
	Tu	16	Coupling	1.6, 1.7, 2.4 3.1 - 3.7, 4.1 - 4.2
	R	18	Coupling and Structure	1.6, 1.7, 2.4 3.1 - 3.7, 4.1 - 4.2
	Tu	23	Double Resonance / Decoupling	5.1 - 5.3
	R	25	Spin Relaxation	7.1 - 7.3
	M,Tu,W	29,30,1	1D double resonance NMR Lab #2	
<b>October</b>				

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	R 2	Special Lecture / Discussion	
<b>EXAM</b>	<b>Tu 7</b>	<b>EXAM 2</b>	
	R 9	Complex Pulse Sequences/Spin Echo	8.1 – 8.2
	Tu 14	Spin Echo	8.3 – 8.4
	R 16	Special Lecture / Discussion	
	Tu 21	INEPT and DEPT	8.5 – 8.6
	R 23	Special Lecture / Discussion	
*****	R 23	<b>MIDPOINT WITHDRAWL DEADLINE</b>	*****
	M,Tu,W 27,28,29	1D <sup>13</sup> C and DEPT NMR Lab #3	
	R 30	Introduction to 2D NMR	9.1 - 9.3
<b>November</b>			
<b>EXAM</b>	<b>Tu 4</b>	<b>EXAM 3</b>	
	R 6	2D COSY / HETCOR	9.4
	M,Tu,W 10,11,12	2D HSQC / COSY NMR Lab #4	
	R 13	2D TOCSY / HSQC	9.4
	Tu 18	Special Lecture / Discussion	
	R 20	Nuclear Overhauser Effect / NOESY	10.1 - 10.4
	Tu 25	Thanksgiving Break – no class	
	R 27	Thanksgiving Break – no class	
<b>December</b>			
	M,Tu,W 1,2,3	NOESY / TOCSY NMR Lab #5	
	R 4	Special Lecture / Discussion	
	Tu 9	Friday class schedule – no class	Last day of class
	W 10	Reading day	
<b>EXAM</b>	<b>R 11</b>	<b>EXAM 4 (3:30 pm - 6:30 pm)</b>	

### ATTENDANCE:

The University of Georgia guidelines for attendance can be found at the following link:  
<http://bulletin.uga.edu/bulletin/ind/attendance.html>.

Attendance policies are at the discretion of the instructor. Attendance in this course will be monitored. For this course, five (5) absences from lectures will result in automatic withdrawal from the course. If the withdrawal is before the midpoint deadline, the grade will be “WP”. After the deadline, the grade will be “WP” if the student is passing, or “WF” if the student is failing. The five (5) absences include absences that may prove to be excused.

No absences from laboratory periods are permitted. A missed laboratory period will result in a score of zero (0) for that laboratory (see below).

No absences from exam periods are permitted. A missed exam will result in a score of zero (0) for that exam (see below).

Examinations missed in the case of emergencies, including personal/family crises, require a signed excuse from the Office of the Vice President of Instruction. No score for a makeup exam will be acknowledged/recorded without this signed excuse.

Examinations missed in the case of personal illness require certification signed by the attending physician describing the illness and validating the absence. This will be presented to the instructor. Contact information for the attending physician will also be provided to the instructor.

In the event that a critical activity has been scheduled well in advance of a scheduled exam, the student can arrange with the instructor for a makeup exam. *This must be done at least two weeks before*

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the examination. In the event it is not, a signed excuse from the Office of the Vice President of Instruction must be provided.

Makeup exams will be given only within four (4) days of the normally scheduled exam. These will be scheduled at the earliest possible time.

For students arriving late for an exam, no additional time beyond the normal exam end time will be given to complete an exam. The same guidelines apply to missed laboratory sessions (see below).

Lectures begin at 3:30. Students who arrive between 3:30 and 3:40 will be considered late. Two (2) such instances of arriving late will constitute one (1) absence. Students who arrive after 3:40 will be considered absent. Likewise, leaving class ten (10) or less minutes before the end of the class period will be equivalent to a late arrival. Leaving class more than ten (10) minutes before the end of the class period will count as an absence.

### ELECTRONIC DEVICES:

No laptops, tablet computers, cell phones, iPhones/iPods/iPads, PDAs or other electronic devices are allowed to be in operation in the classroom. All such, or related, devices must be turned off before entering the classroom, and must be off of the desktop during class (in a bookbag or on the floor). The exception is, for exams, each student should bring a hand-held calculator to each exam.

### GRADING:

Grades will be based on exams and written laboratory reports. There are three (3) in-class exams and one (1) exam held during the scheduled final exam period, for a total of four (4) exams. There are five (5) laboratory sessions and a total of five (5) written laboratory reports. The grade in the course will be assigned based on the highest three (3) exam scores and the highest four (4) written laboratory report scores. The three (3) highest exam scores will count 75% toward the final grade, and the four (4) highest laboratory scores will count 25% toward the final grade.

Consideration for re-grading of an exam requires that the student request the re-grading no more than one (1) week after the graded exam is returned. A written statement detailing the justification for consideration of re-grading must also be provided.

### EXAMS:

There are three (3) in class exams and one (1) exam held during the scheduled final exam period for a total of four (4) exams. All exams are comprehensive. The length of the last (4<sup>th</sup>) exam will be similar to the in class exams, but students will have the full examination time (approximately three hours) to answer the questions. The last (4<sup>th</sup>) exam does not count more towards the final grade than the in class exams. An absence from any exam will result in a score of zero (0) for that exam.

Exams will cover all material discussed in class, all material found in the lecture notes, and all material in the reading assignments.

The final (4<sup>th</sup>) exam may only be rescheduled for a student if the University "Final Exam Schedule Exam Conflicts" criteria are met:

(<http://www.curriculumsystems.uga.edu/FinalExamConflicts/FinalExamConflicts.html>). Under no circumstance will the final (4<sup>th</sup>) exam be rescheduled to accommodate end of semester travel plans.

### LABORATORY / WRITTEN LABORATORY REPORTS:

There are five (5) laboratory sessions and a total of five (5) written laboratory reports. A written report is required for each lab. *The laboratory reports are typed.* These are generally due one (1) week after the scheduled laboratory period. An absence from a laboratory session will result in a score of zero (0) for that lab/report. The written laboratory reports will be original works of a single individual, will not be written by teams, and will not be the result of joint efforts between two or more students.

### ACADEMIC HONESTY:

All students will abide by the academic honesty policies of the University of Georgia:

<http://ovpi.uga.edu/about-ovpi/ovpi-units/academic-honesty>

<https://ovpi.uga.edu/sites/default/files/uga-academic-honesty-policy-may-07.pdf>