CHM5580: NMR Spectroscopy - Spring 2026 - v. 4.0 - Updated Oct. 31, 2025

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Website:	https://www.chem.fsu.edu/~schurko/ - notes on **Canvas**
Lecture Times:	To be determined by class members
Office Hours:	By appointment (on Zoom or in person)
Location:	To be determined or on Zoom (if required)
Tutorials:	Prior to examinations (in class or on Zoom)
Assignments:	7 assigned problem sets, not handed in for marks. 5-6 brief assignments/quizzes to keep students up to date

All dates and times will be updated in the latest version of the syllabus and on the Canvas web site (all course materials are available here). Students should communicate through the Canvas site to ensure rapid responses.

I. Course Description

Theory and applications of NMR in chemical problems, including the origin of the NMR phenomenon, Fourier transforms, spectral processing, spectrometer hardware, pulse sequences, NMR interactions, NMR relaxation, dynamical processes and chemical exchange, double-resonance experiments, and two-dimensional NMR.

II. Instructional Materials

The course is largely based upon the notes that are handed out in each class, as well as written notes that summarize various concepts. Students receive approximately 25 sets of notes and 7 sets of tutorial problems.

There is not a mandatory textbook for the course; suggested readings come from:

1. Keeler, J. *Understanding NMR Spectroscopy*. John Wiley & Sons, Chichester, U.K, 2005 ISBN 13978-0-470-01786-9 (soft cover).
2. Hore, P.J.; Jones, J.A. and Wimperis, S. *NMR: The toolkit.* Oxford University Press, Oxford, U.K., 2000. An Oxford Chemistry Primer. ISBN 0 19 8504152 (soft cover).
3. Levitt, M.H. *Spin Dynamics: Basics of Nuclear Magnetic Resonance.* John Wiley & Sons, New York, 2001. ISBN 0471489220 (soft cover).
4. Claridge, T.D.W. *High-Resolution NMR Techniques in Organic Chemistry*. Elsevier Science, The Netherlands, 1999. ISBN 0080427987 (soft cover).

III. Course Objectives and Learning Outcomes

1. To provide the student with an understanding of the physical basis of NMR, all the way from nuclear spin to modern two-dimensional NMR techniques.
2. To train the student in the practical aspects of NMR spectroscopy, including spectral processing, experimental design, and utilizing NMR hardware.
3. To encourage the student to utilize a wide variety of NMR experiments and techniques to aid in their ongoing research, and to not regard the NMR experiment as a black box.

IV. Tutorials and Laboratories

Tutorial sessions are offered prior to all quizzes and/or examinations. There is currently no laboratory component for this course, though several laboratory demonstrations will be given.

V. Mark breakdown and guidelines

Item:	Grade Value:	Date:
Mid-term 1	20%	TBA - after L9
Mid-term 2	20%	TBA - after L17
Assignments/Quizzes	15%	Throughout course
Presentation*	15%	April 22, 2026 - In class
Final Exam	30%	Weed of Apr. 27-May 1 (TBA)

*The presentation is on any topic in magnetic resonance; it can be directly related to your research activities or a topic you are interested in. The topic will be discussed and cleared before **Feb. 16, 2026**. Presentations are 15-20 minutes in length, plus time for questions.

A. Attendance is VERY IMPORTANT to be successful in this course - students who do not attend lectures generally score very low on quizzes and exams. **You must keep up with the material as the semester progresses.**

B. To arrange a consultation time with Dr. Schurko, please **make an appointment by email**. Office hours and tutorials, which occur outside of class hours, are flexible and will be adjusted around your schedule of classes, TA responsibilities, and research activities.

C. Updated versions of lecture notes will be provided online before class (on Canvas), and adequate lecture notes should be taken as a complement. Students are encouraged to consult with the instructor about any material that is unclear.

D. Problem sets are handed out as the course progresses, and are directly related to material from the notes. Answer keys are available for these problem sets.

E. 6-7 short assignments/quizzes will be handed out to keep the students up to date with course materials.

F. Exams missed due without an official excused absence will result in a grade of zero. Only students with an official excused absence will be given the opportunity to make-up an exam. **If for health or personal reasons an exam must be missed, you must notify Dr. Schurko by email ±12 hours before or after the exam.**

G. All students are required to take the final examination in order to receive a passing grade in the course. No notebooks, texts or cheat sheets are allowed in any of the examinations. Students caught cheating will be subject to academic discipline.

Outline of Course Material

Section 1: Introduction to NMR
Lecture 1: NMR in Context: Spectroscopy; History of NMR; Nuclear Spin
Lecture 2: Vector Model, Semi-Classical Model, Rotating Frame
Lecture 3: Quantum Mechanics of NMR
Lecture 4: Spin Operators
Lecture 5: Density Matrix Theory: Populations and Coherences

Section 2: Fourier Transform NMR & The NMR Spectrometer
Lecture 6: The Basic FT NMR Experiment
Lecture 7: The Fourier Transform in NMR
Lecture 8: Spectral Processing and Data Manipulation
Lecture 9: The NMR Spectrometer; Practical Considerations
Lecture 10: Phase Cycling and Pulse Sequences

Section 3: NMR Interactions, Relaxation and Chemical Exchange
Lecture 11: NMR Interactions: Introduction, Quadrupolar Interaction
Lecture 12: Chemical Shielding
Lecture 13: Direct Dipole-Dipole Interaction
Lecture 14: Indirect Spin-Spin Interaction (J-Coupling)
Lecture 15: Relaxation in NMR
Lecture 16: Relaxation Mechanisms and Dynamic Motions
Lecture 17: Chemical Exchange Phenomena

Section 4: Advanced Topics in NMR
Lecture 18: Coherences and the AX Spin System
Lecture 19: Double Resonance Experiments, Part 1
Lecture 20: Double Resonance Experiments, Part 2
Lecture 21: Introduction to 2D NMR, J-resolved and COSY Experiments
Lecture 22: General Features in 2D NMR
Lecture 23: Survey of 2D NMR Techniques
Lecture 24: Introduction to Solid-State NMR (tentative – much is covered in the course)
Lecture 25: Student Presentations: Special Topics in NMR

Examinations

All examination dates will be decided upon in class during the first week.

Florida State University Policies

UNIVERSITY ATTENDANCE POLICY:
Excused absences include documented illness, deaths in the family and other documented crises, call to active military duty or jury duty, religious holy days, and official University activities. These absences will be accommodated in a way that does not arbitrarily penalize students who have a valid excuse. Consideration will also be given to students whose dependent children experience serious illness.

ACADEMIC HONOR POLICY:
The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of students' academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to "...be honest and truthful and...[to] strive for personal and institutional integrity at Florida State University." (Florida State University Academic Honor Policy, found at http://fda.fsu.edu/Academics/Academic-Honor-Policy)

AMERICANS WITH DISABILITIES ACT:
Students with disabilities needing academic accommodation should:
(1) register with and provide documentation to the Student Disability Resource Center; and
(2) bring a letter to the instructor indicating the need for accommodation and what type.
Please note that instructors are not allowed to provide classroom accommodation to a student until appropriate verification from the Student Disability Resource Center has been provided.
This syllabus and other class materials are available in alternative format upon request.
For more information about services available to FSU students with disabilities, contact the:
Student Disability Resource Center
874 Traditions Way - 108 Student Services Building
Florida State University
Tallahassee, FL 32306-4167
(850) 644-9566 (voice)/(850) 644-8504 (TDD)
sdrc@admin.fsu.edu
http://www.disabilitycenter.fsu.edu/

SYLLABUS CHANGE POLICY:
Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.

IMPORTANT DATES:

January 8, 2026	Classes Begin
January 19, 2026	Martin Luther King, Jr. Day. No classes.
March 16-20, 2026	Spring Break. No classes.
April 24, 2026	Last Day of Classes
April 27 - May 1, 2026	Final Exam Week