

Chemistry 625

Spring 2025

Chemical Applications of Nuclear Magnetic Resonance Spectroscopy

Instructor: Dr. Surya Prakash email: gprakash@usc.edu

Days and Time: Tue. & Th., 9.30 -10.50 AM.

Class Location: LHI Olah Library, 3rd Floor

Office: LHI 203

This course will not have any formal prescribed texts. Material from the following suggested books will be used from time to time.

- “Basic One- and Two-Dimensional NMR Spectroscopy”, H. Friebolin, 5th Edition, Wiley-VCH, A Paperback, 2016.
- “Organic Structure Analysis”, P. Crews, J. Rodriguez and M. Jaspars, Oxford University Press, Oxford, 2010, Second Edition.
- “NMR Spectroscopy, Basic Principles, Concepts and Applications in Chemistry”, H. Günther, Wiley-VCH, 3rd Edition, A Paperback, 2013.
- “Understanding NMR Spectroscopy”, J. Keeler, 2nd Edition, Wiley, A Paperback, 2010.
- “Modern NMR Techniques for Chemistry Research”, A. E. Derome, Pergamon Press Inc., (flexi cover), 1991.

Exams: Dates TBD

Grade: 2 Midterm Tests (40%), Final Term Paper on selected topics (40%), Occasional problem sets (20 %).

Syllabus: Outline of the material that will be covered.

Introduction to Nuclear Magnetic Resonance (NMR) Spectroscopy

Physical Aspects of NMR and Basic Theory- Single Pulse Experiment

FT NMR

Experimental Aspects

¹H NMR spectra of Organic Molecules

¹H NMR Chemical Shifts and Spin-Spin Coupling Constants

Origin of Chemical Shifts and Coupling Constants

¹³C and ¹⁹F NMR Spectroscopy

Spin Decoupling

NMR of Other Nuclei

Dynamic NMR

CIDNP

Multiple Pulse Experiments

Polarization Transfer

Spectral Editing

Connectivity through Bonds, Space and Chemical Exchange

Two Dimensional NMR

NMR of Solids

Imaging

Theoretical Methods (IGLO, GIAO)

NMR Bibliography

- “Carbon-13 Nuclear Magnetic Resonance Spectroscopy”, G.C. Levy, R.L. Lichter and G. Nelson, John Wiley and Sons, New York, 1980.
- “Nuclear Magnetic Resonance Spectroscopy”, R.K. Harris, Longman Scientific.
- “Proton and Carbon-13 NMR Spectroscopy- An Integrated Approach”, R.J. Abraham and P. Loftus, Heyden, London, 1978.
- “Practical NMR Spectroscopy”, M.L. Martin, J.-J. Delpuech and G.J. Martin, Heyden, London, 1980.
- “Experimental Pulse NMR- A Nuts and Bolts Approach”, E. Fukushima and S.B. Roder, Addison-Wesley, New York, 1981.
- “Handbook of High-Resolution Multinuclear NMR”, C. Brevard and P. Granger, John Wiley and Sons, New York, 1981
- “Dynamic NMR Spectroscopy”, J. Sandstrom, Academic Press, 1982.
- “Solid State NMR for Chemists”, C. Fyfe, C.F.C. Press, Guelph, Ontario, Canada 1983.
- “Nuclear Magnetic Resonance Imaging in Medicine and Biology”, P.G. Morris, Calrendon Press, Oxford 1985.
- "NMR Basic Principles and Progress", Springer Verlag, Volumes 1-33. Each volume is dedicated to a particular nucleus or technique.
- "NMR Spectroscopy Techniques", C. Dyboski and R. L. Lichter, eds., Marcel Dekker, Inc., New York, 1987.
- “A Complete Introduction to Modern NMR Spectroscopy”, Roger S. Macomber, Wiley, New York, 1998.
- “200 and More NMR Experiments, A Practical Course”, S. Berger and S. Braun, Wiley-VCH, Weinheim, 2004.
- “Applied NMR Spectroscopy for Chemists and Life Scientists”, O. Zerbe, S. Jurt, Wiley-VCH, Weinheim, 2014.
- “High-Resolution NMR Techniques in Organic Chemistry”, 3rd ed., T. Claridge, Elsevier, 2016.
- “Organic Structures from 2D NMR Spectra”, L. Field, H. Li, A. Magill, Wiley, 2015.