

# Chemistry 824

## Nuclear Magnetic Resonance Spectroscopy

### Syllabus

Autumn Quarter 2011  
1008 McPherson Lab  
MWF 12:30 PM - 1:18 PM

**Instructor:** Philip Grandinetti  
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**Objective and Clientele:** Intensive lab and lecture treatment of NMR spectroscopy for structural studies. Intended for beginning graduate students or practitioners of analytical chemistry who seek expertise in nuclear magnetic resonance spectroscopy in the context of chemical and biochemical structural studies. Lectures cover theory, instrumentation, and applications, while lab experiments involve commercial instruments and examples of practical applications.

**Prerequisites:** Undergraduate physics (phys. 122 or equivalent)

#### Evaluation:

1. One midterm (40%)
2. Final exam (40%).
3. Homework (10%)
4. Written report (10%)

#### Course Outline:

1. Vector Picture of Pulsed NMR experiments
  - Bloch Equations, Relaxation Times, The Rotating Frame, The Fourier Transform, Spin Echoes, Chemical Exchange, Multi-dimensional NMR.
2. Inside the NMR spectrometer
  - Tuning the NMR Probe, Inside the Transmitter and Receiver, NMR Pulse Programming
3. Acquiring and Processing NMR Data
  - One- and two-dimensional NMR experiments, Calibration and selection of experimental parameters, Fourier Transform, Phase Corrections, Time-domain apodizations.
4. Quantum Description of NMR - Part I.
  - Spin Operators, Quantum Dynamics, Interaction Frame Representation, Pulses and NMR Transitions
5. Information Content of NMR Interactions
  - Chemical Shift Interaction, J-Coupling Interaction, Dipolar Interaction, Quadrupolar Interaction, Density Operator, Theory of Relaxation

## 6. Quantum Description of NMR - Part II.

- Quantum Description of Multi-Pulse NMR experiments, Coherence Transfer Pathways and Phase Cycling

To have an exam question re-graded, turn in a written description of your concern no later than **one class period** after the exam was returned to you. Each exam in question will be re-graded in its entirety.

All students with documented disabilities, who need accommodations, should see the instructor privately to schedule an appointment as early in the quarter as possible. If your disability requires materials in alternative format, please contact the Office for Disability Services at 292-3307, Room 150 Pomerene Hall.

**ACADEMIC MISCONDUCT:** Any material submitted in Chem. 221 must represent your own work. Apparent violations of this standard will be referred to the University Committee of Academic Misconduct (COAM) as required by Faculty Rules. Please read the attached statement on Standards of Academic Conduct carefully. See the URL:

<http://oaa.osu.edu/coam/home.html>

for further information about the Student Code of Conduct.