

CHEM*760 NMR Spectroscopy for Chemists Fall 2011

(preliminary course outline)

Instructor: Prof. Glenn Penner
Dept. of Chemistry, Univ. of Guelph
gpenner@uoguelph.ca
519-824-4120 ext. 52602

All course material (lecture notes, etc.) will be provided.

1. Basic Background and Review
 - a) Chemical Shifts
 - b) Spin-spin coupling
 - c) Multinuclear NMR

2. Analysis of 1D Solution NMR Spectra
 - a) 2nd order spectra
 - b) Spin systems
 - c) Spectral analysis
 - d) Effects of Quadrupolar nuclei

3. The NMR Experiment
 - a) Components of the NMR spectrometer
 - b) Radiofrequency pulses and the rotating frame
 - c) The FID and FT (the vector model)
 - d) Instrumental details (phasing, shimming, etc.)
 - e) Processing NMR spectra

4. Special Techniques
 - a) Double resonance
 - b) Pulse sequences (J-mod, DEPT, INEPT, etc.)

5. Multi-dimensional NMR

- a) COSY and related experiments
- b) HETCOR and related experiments
- c) INADEQUATE
- d) NOESY
- e) other 2D methods
- f) Higher dimensional NMR spectroscopy

6. Effects of Molecular Dynamics

- a) Types of molecular dynamics
- b) Effect on chemical shifts
- c) Effect on J coupling
- d) Analysis

7. Relaxation Times

- a) What is relaxation and what causes it?
- b) Relaxation mechanisms
- c) Practical importance of relaxation

8. Solid State NMR

- a) How does it differ from solution spectroscopy?
- b) Anisotropic interactions – what information can we get?
- c) Obtaining narrow spectra

Evaluation:

Midterm	30%
Assignments (10% x 2)	20%
Short project & presentation (10% x 2)	20%
Final (Wed.	30%

The midterm will be held in Guelph on Oct. 19 (in class) and will cover lectures 1 – 5.

Problem Set #1 will be handed out on Wednesday Oct. 5 and is due Friday (12 noon) Oct. 40. Marked problem sets and answers will be returned on Monday Oct. 17.

Problem Set #2 will be handed out on Friday Nov. 18 and is due Friday Nov. 25 (12 noon). It will be returned on Nov. 30 (in class).

The Seminars will be held at the University of Guelph (room to be announced).

The project is due Friday Dec. 9.

The final will be held at the University of Guelph on Wednesday Dec. 7 and will cover mostly lectures 6 – 10.

- This course is intended for those who want to *understand* NMR spectroscopy *without* going into the theoretical details of a Physical Chemistry or Physics based course.
- This course is meant to provide Graduate level students with an understanding of NMR spectroscopy which goes beyond that found in a typical “organic spectroscopy” course.
- Students interested in the more physical/theoretical course on NMR spectroscopy should take CHEM*750/7500.
- Students who simply want to learn how to “assign” spectra of organic molecules should take “Organic Spectroscopy” CHEM*766/7660.