Chem 286: NMR methodology course syllabus

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Lab component

January 18  course overview; lab structure & schedule labs
NMR spectrometer: magnet, console, computer, probe

Jan 23 & 25  NMR active nuclei, principles behind NMR (how and why it works)
Principles behind NMR: E-levels, Boltzmann distribution

lab 1:  $^1$H 1D on Bruker & using MNova

Jan 30 & Feb 1  The vector model of NMR: rotating frame, the pulse & QPD

February 6 & 8  The vector model (cont’d): phase cycling, Nyquist & sampling the FID
Recording the spectrum: time and frequency domains

Feb 13 & 15  Practical aspects of $^{13}$C NMR
NOE enhancement vs. Polarization Transfer (DEPT, INEPT)

lab 2:  $^{13}$C 1D & DEPT on Bruker

February 22  Chemical shifts and coupling
Electron shielding; origin of spin-spin coupling

Feb 27 & Mar 1  X-nuclei NMR and kinetics by NMR

lab 3:  $^{19}$F & $^{31}$P 1D on Bruker

March 6 & 8  Midterm exam
T1 & T2 relaxation; Mechanisms of relaxation

March 20 & 22  Review of calibrating the 90° pulse
Intro to 2D NMR; Homo vs. heteronuclear experiments

lab 4:  quantitative $^1$H 1D on Varian

March 27 & 29  COSY vs. TOCSY spectroscopy
1H-1H thru bond experiments

April 3 & 5  1H-1H thru space experiments
2D NOESY vs. ROESY theory and practice

lab 5:  COSY/TOCSY on Varian

April 10 & 12  special topics ideas: RDCs, protein NMR, large molecule NMR, DOSY
Prep for end-of-semester student presentations

April 17 & 19  $^1$H-$^{13}$C HSQC (1-bond) and HMBC (2,3-bond) spectroscopy
Experiment setup; data interpretation

lab 6:  HSQC/HMBC on Varian

April 24 & 26  Dynamic NMR: lineshape analysis vs. Coalescence T; rate constants $k_c$
Intermolecular exchange processes

May 1 & 3  Final: student presentations on special NMR topics