Chemistry 598 - Syllabus

Principles of Magnetic Resonance, Spring 2012

January 3, 2012

General Information:

Class: T & TH 9:00-10:15 AM
Interdiscip. Science & Techn. Building I (ISTB1), Room 474 and Physical Sciences Building (PS), Room H530.

Teachers: Course NMR Instructor: Jeff Yarger, ISTB1 470, jeff.yarger@asu.edu

Office hours: T & TH. 10:15-11:30 AM.
or by appointment (skype ID: jlyarger – google voice: 604-4YARGER)

Web Site: http://myasucourses.asu.edu
A Blackboard course management website entitled 'Principles of Magn. Reson. Spectroscopy' will be used to post ALL relevant material in this course.

Optional Material & Textbooks

No required textbook. However, I recommend the following books as references:

(1) Spin Dynamics: Basics of Nuclear Magnetic Resonance., 2nd Ed. by Malcolm Levitt
(2) Principles of Nuclear Magnetism, A. Abragam
(3) Understanding NMR spectroscopy, 2nd Ed., by James Keeler
(4) Principles of Nuclear Magnetic Resonance in One and Two Dimensions, by R. Ernst, G. Bodenhausen and A. Wokaun.
(5) Principles of Magnetic Resonance, by C. P. Slichter
(6) Principes of Nuclear Magnetic Resonance Microscopy., by Paul Callaghan

And the following two online books for reference:
http://www.cis.rit.edu/htbooks/nmr/
http://www.cis.rit.edu/htbooks/mri/

Lectures

Lectures are designed to outline, discuss, and demonstrate principles of Magnetic Resonance. Lecture notes will be posted on the class web site. The course is taught in ISTB1 474 and in PSH530, the computer lab, so that we can do "hands-on" magnetic resonance exercises in class.

Homework

Several homework assignments will be made during the semester. Information will be posted on the course Blackboard website. All homework assignments will be graded and students are expected to complete them independently, unless otherwise instructed. No late homework will be accepted and announcements about the due date for homework will be made on Blackboard

and in class. Several homework assignments will be aided by computer software such as Mathematica and/or Matlab. These programs are provided as site-licenses at ASU and install on the computers in PSH530.

Class Projects

Students are required to complete two project during the semester. This course is designed to provide an overview of the fundamental principles in magnetic resonance. Class projects are designed to allow students to obtain practical experience with magnetic resonance theory, analysis and simulations in specific areas that best suits their research interests. Most projects will require students to use Mathematica and/or Matlab for data simulation and scientific plotting or illustrations. All Mathematica and/or Matlab programs should be self-contained with text descriptions of all input and simulation parameters. All projects must be submitted electronically and written in ms-word, pages or latex. The original typeset files, PDF version and all associated data files should be submitted as a single zip file. For additional credit, a video podcast (screencast) version can also be submitted. The instructor must approve project topics and outlines and the due dates are listed below:

	Topic & Outline Approval	**Project Due Date**
Project 1:	TH, Feb. 9th	Fri., Mar. 2nd
Project 2:	TH, Mar. 29th	Fri., Apr. 27th

Magnetic Resonance has a plethora of different types of hardware designs, pulse sequences, data analysis techniques, and data simulation and modeling methods. Details about these projects will be discussed during lecture and posted on Blackboard. The written project document that is turned in should enable the reader to understand the general technique and provide a "learn by doing" guideline. Also, a supplemental section should be included that contains a zip file with ALL associated data to setup, run and compare the "method" described. The supplement section should provide a detailed description of all associated data files in the compressed (zip) file. Also, include a description of all programs, software, etc. needed to reproduce the presented method results.

Grades

Your grade for the class will be based on the two required class projects and the assigned homework. To receive a grade in this class you must submit both required projects and ALL assigned homework. Projects and homework will be given an A-F grade. Projects should be written in a publication style similar to the *Concepts in Magnetic Resonance*. An "A" represents a project that can be used without any major scientific corrections or revisions. A "B" will be a submitted project that requires minor editing of the scientific concepts. A "C" will be a project that requires major editing before it would be acceptable for publication on the Magnetic Resonance Research Center (MRRC) website. Homework will also be graded A-F and will account for 50% of your grade in the course. All grades will be posted on Blackboard.

Tentative Lecture Outline – Spring 2012

Date	Lecture Topic	Comments
Th 1/5	Introduction Intro. to Magnetism	Course Syllabus
T 1/10 Th 1/12	NMR Spectroscopy NMR Spectrometer and FT NMR	
T 1/17 Th 1/19	Quantum Mechanics Quantum Basics for NMR	
T 1/24 Th 1/26	Nuclear Spin Hamiltonians Spin Interactions	
T 1/31 Th 2/2	Single and Ensembles of Spins-1/2 Single and Ensembles of Spins-1/2	
T 2/7 Th 2/9	Experiments on Non-Interacting Spins-1/2 Experiments on Non-Interacting Spins-1/2	**Project #1 Outline DUE**
T 2/14 Th 2/16	Quadrupolar Nuclei Quadrupolar Nuclei	
T 2/21 Th 2/23	Spin-1/2 Pairs Spin-1/2 Pairs	
T 2/28 Th 3/1	Homonuclear AX Systems Homonuclear AX Systems	**Project #1 DUE (3/2)**
T 3/6 Th 3/8	Homonuclear AX Systems Experiments on AX Systems	
T 3/13 Th 3/15	Experiments on AX Systems No Class	
T 3/27 Th 3/29	AX Spin Systems AX Spin Systems	ACS Meeting **Project #2 Outline DUE**
T 4/3 Th 4/5	Many-Spin Dynamics Many Spin Dynamics	
T 4/10 Th 4/12	Motion Relaxation	
T 4/17 Th 4/19	ENC ENC	**No Class**
T 4/24 Th 4/26	Relaxation Makeup Class	
T 4/27	**PROJECT #2 DUE**	**PROJECT #2 DUE**