INFORMATION SHEET

Instructor: Thomas Liu, Department of Radiology
                       Center for Functional Magnetic Resonance Imaging (fMRI), Room 1001
                       (858) 822-0542 , ttliu@ucsd.edu

Teaching Assistant: Jia (Tim) Guo (Office hours: Mondays:TBD; Wednesdays 3:30 to 4:30
                       pm in Center for fMRI Conference Room)

Lectures: Tuesdays/Thursdays 9:30 a.m. to 10:50 a.m., Powell-Focht
                       Bioengineering Hall, Room 161

Office Hours: Tuesdays 4 to 5 pm; Wednesdays 12 pm to 1 pm or by appointment.
                       Center for fMRI Conference Room.

Prerequisites: Graduate Standing or Consent of Instructor.

Required Texts: Medical Imaging Signals and Systems, Jerry L. Prince and Johnathan M.
                       Links, Prentice Hall 2006.   Errata available at
                       http://iacl.ece.jhu.edu/~prince/mibook/mierrata-v1.03.pdf

                       Principles of Magnetic Resonance Imaging, Dwight G. Nishimura (we
                       will order copies of this from the author)

Course Web Site: http://cfmriweb.ucsd.edu/ttliu/BE280A_09.html
                       (mirror site: http://fmriserver.ucsd.edu/ttliu/BE280A_09.html)
                       Lecture notes will be posted on the web by 5 p.m. the day before the class.

Course e-mail list: Course e-mails will be sent through StudentLink to registered students.

Course Description: Fundamentals of Fourier transform and linear systems theory including
                       convolution, sampling, noise, filtering, image reconstruction, and
                       visualization with an emphasis on applications to biomedical imaging.
                       Examples from optical imaging, CT, MRI, ultrasound, nuclear, PET, and
                       radiography.

Grading: 25% Homework/Quizzes/Class Participation, 35% Midterm Project, 40%
                       Final Project

Tentative Syllabus

Week 1
Thursday 9/24   Course Policies, Overview of Imaging Modalities; CT example

Week 2
Tuesday 9/29   X-rays: Basic Physics; Contrast; Source and object magnification.
Thursday 10/01   X-ray imaging solution; Delta functions and signal expansions; impulse
                       response.

Week 3
Tuesday 10/06   Review Signal Expansions; Linearity; Superposition; Shift Invariance;
                       Convolution
Thursday 10/08   X-ray imaging equation; Begin CT;

Week 4
Tuesday 10/13   Radon Transform; Backprojection; Begin Fourier Transforms;
Thursday 10/15   Fourier Transform theorems; Modulation Transfer Function.

Week 5
Tuesday 10/20   Convolution Theorem; CT: Projection Slice Theorem;
Thursday 10/22   Filtered back projection; Sampling: 1D and 2D sampling, Whitaker-Shannon
                       sampling theorem, aliasing; Application to CT

Week 6
Tuesday 10/27   MRI: Overview, Basic physics, Bloch Equation MRI: Gradients, Signal
                       Equation, Spin-warp pulse sequence
Thursday 10/29   Sampling Reviewed; MRI: Resolution and sampling requirements

Week 7
Tuesday 11/03   MRI: Slice Selection; RF Pulse design
Thursday 11/05   MRI: Image Contrast and Noise

Week 8
Tuesday 11/10   MRI: Fast Imaging Methods
Thursday 11/12   MRI: Advanced Image Reconstruction

Week 9
Tuesday 11/17   MRI: Applications
Thursday 11/19   Ultrasound: Overview and basic physics

Week 10
Tuesday 11/24   Ultrasound: Beam formation; Scanning; Sampling Reviewed
Thursday 11/26   **NO CLASS: Thanksgiving Holiday**

Week 11
Tuesday 12/01   Ultrasound: Phased Array systems, Doppler
Thursday 12/03   Emerging Modalities

Week 12
Finals Week   Final project presentations (8 am to 11 am) on day of scheduled final.