BIOM5200/SYSC5304/BMG5200 Biomedical Image Processing

Course Outline (Winter 2012)

♦ Calendar Description
Mathematical models of image formation based on the image modality and tissue properties. Linear models of image degradation and reconstruction. Inverse problems and regularization for image reconstruction. Image formation in radiology, computed tomography, magnetic resonance imaging, nuclear medicine, ultrasound, positron emission tomography, electrical impedance tomography.

Note:
The objective of the course is to learn how to "process" signals to obtain medical images for each modality (based on its physics, mathematical modeling and instrumentation) but not digital signal processing (DSP) of medical imaging.

♦ Prerequisites
OCIECE/OCIBME graduate students, or permission of the instructor.

♦ Course Textbook
Medical Imaging Signals and Systems, by J.L. Prince and J.M. Links, Pearson Prentice Hall, 2006

♦ Course Instructor
Yuu Ono, Room #6205 Canal Building, 613-520-2600 (ext.8787), yuuono@sce.carleton.ca

♦ Web Site
Course materials will be placed on the course web site, so students are expected to have Internet access. The course URL is: www.sce.carleton.ca/courses/biom-5200/w12/

♦ Assignment
There will be **five** graded assignments that will be posted on the course website.

♦ Project
Objectives of the project are: getting familiar with advanced technology, current limitation and challenges of medical imaging; and training for presenting and writing a research proposal and/or introduction of thesis. Students select a topic in the area of medical imaging, review 10-15 literatures of the topic, and propose possible research subjects. Students are encourage to select a topic of interest or relevant to their studies in the area of medical imaging. The project report is for evaluation purposes only and will not be returned to the students.

Project Tasks:

Work	Description
Abstract of proposal	Abstract is 1-2 pages (double spaced). Include a title, brief introduction of technology, background, problem descriptions (such as limitations, issues, challenges, future improvement, etc), proposed techniques or methods if you already have such ideas, and (at least 5) references.
Presentation	Presentation is ~10 min followed by questions (~5 min). Marks are based on technical content, clarity of presentation, visual of presentation slides, and ability to answer questions.
Final report	Final proposal is 10−20 pages (double spaced). Marks are based on the technical content, consistency of discussion and clarity of its presentation for review of current techniques (introduction, background, techniques, state of the art, etc), analysis of problems (limitations, issues, challenges, future improvement, etc), and proposed research subjects (needs, impact, etc).

♦ Final Exam

The final exam will be held during the University's formal examination period. Do not make travel plans until the exam has been scheduled. The final examination is for evaluation purposes only and will not be returned to the students. Students who miss the final exam may be granted permission to write a deferred examination (see the Graduate Calendar for regulations on deferred exams).

♦ Marking Scheme

Work	Value
Assignments	30%
Project - Abstract - Presentation - Final report	30% - 5% - 10% - 15%
Final Exam	40%

♦ Plagiarism

Plagiarism and cheating at the graduate level are viewed as being particularly serious and the sanctions imposed are accordingly severe. Students are expected to familiarize themselves with and follow the Carleton University Student Academic Integrity Policy (See http://www2.carleton.ca/fgpa/student-forms/policies-and-guidelines/). The Policy is strictly enforced and is binding on all students. Plagiarism and cheating – presenting another's ideas, arguments, words or images as your own, using unauthorized material, misrepresentation, fabricating or misrepresenting research data, unauthorized co-operation or collaboration or completing work for another student – weaken the quality of the graduate degree. Academic dishonesty in any form will not be tolerated. Students who infringe the Policy may be subject to one of several penalties including: expulsion; suspension from all studies at Carleton; suspension from full-time studies; and/or a reprimand; a refusal of permission to continue or to register in a specific degree program; academic probation; or a grade of Failure in the course.

♦ You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

Pregnancy obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the Equity Services website
http://www2.carleton.ca/equity/accommodation/
Religious obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the Equity Services website
http://www2.carleton.ca/equity/accommodation/
Students with disabilities requiring academic accommodations in this course must register with the Paul Menton Centre for Students with Disabilities (PMC) for a formal evaluation of disability-related needs. Documented disabilities could include but are not limited to mobility/physical impairments, specific Learning Disabilities (LD), psychiatric/psychological disabilities, sensory disabilities, Attention Deficit Hyperactivity Disorder (ADHD), and chronic medical conditions. Registered PMC students are required to contact the PMC, 613-520-6608, every term to ensure that I receive your Letter of Accommodation, no later than two weeks before the first assignment is due or the first in-class test/midterm requiring accommodations. If you only require accommodations for your formally scheduled exam(s) in this course, please submit your request for accommodations to PMC by the deadlines published on the PMC website: http://www2.carleton.ca/pmc/new-and-current-students/dates-and-deadlines/

♦ **Tentative Schedule**

Week	Subject	Textbook Chapter
1	Course overview Introduction of medical imaging Signals and system	 Ch 1 Ch 2
2	Imaging quality	Ch 3
3	Physics of radiography	Ch 4
4	Projection radiography	Ch 5
5	Computed tomography (CT)	Ch 6
6	Physics of nuclear medicine Planer scintigraphy	Ch 7 Ch 8
7	Emission computed tomography (SPECT, PET)	Ch 9
8	Physics of ultrasound	Ch 10
9	Ultrasonic imaging systems Electrical impedance tomography (Guest lecture by Prof. A. Adler)	Ch 11 EIT
10	Physics of magnetic resonance	Ch 12
11	Magnetic resonance imaging (MRI)	Ch 13
12	Project presentation Course review and wrap up	

Every student should have a copy of our Health and Safety Manual. An electronic version of the manual can be found at www.sce.carleton.ca/courses/health-and-safety.pdf.