<table>
<thead>
<tr>
<th>week</th>
<th>date</th>
<th>lecture topics</th>
<th>reference</th>
</tr>
</thead>
</table>
| 1    | 9/9   | introduction, medical imaging systems  
physics of x-ray                                                                 | Chap 1    |
| 2    | 9/16  | GUI-based programming for image analysis (#1): intro  
 x-ray contrast, SNR, dose  
 quantum mottle, unsharpness, beam hardening                           | Chap 2    |
| 3    | 9/23  | GUI-based programming for image analysis (#2): filters - tutorial by TA  
 four generations of computer-assisted tomography (CAT) systems  
 tomography reconstruction                                                   | Chap 4    |
| 4    | 9/30  | convolution, backprojection  
Radon transform, inverse Radon Transform,  
central slice theorem                                                        | Chap 5    |
| 5    | 10/7  | exam #1  
 algebraic reconstruction technique  
 GUI-based programming for image analysis (#3): area measurement               |           |
| 6    | 10/14 | nuclear medicine: physics of radioactive isotopes  
 scintillation gamma camera  
 single photon emission computed tomography (SPECT)                               | Chap 6    |
| 7    | 10/21 | positron emission tomography (PET)  
 GUI-based programming for image analysis (#4): area measurement                        |           |
| 8    | 10/28 | diagnostic ultrasound, physics and instrumentation  
 2D and color Doppler echocardiography  
 color Doppler echocardiography                                               | Chap 7    |
| 9    | 11/4  | clinical use of echocardiography  
 magnetic resonance imaging (MRI)  
 MRI physics and instrumentation                                               | video     |
| 10   | 11/11 | exam #2  
 research topic: automated tracking of blood vessels  
 GUI-based programming for image analysis (#5): final project                   | handout   |
| 11   | 11/18 | student project presentation - Phase I  
 student project presentation - Phase I  
 research topic: automated analysis of mitochondria images                      | handout   |
| 12   | 11/25 | no class (Thanksgiving recess)                                                                                           |           |
| 13   | 12/2  | research topic: directional low-pass filter  
 MATLAB® Image Processing Toolbox (IPT)                                        | handout   |
| 14   | 12/9  | student project presentation - Phase II  
 MATLAB® Image Processing Toolbox (IPT) Part 2                                  |           |
| 15   | 12/16 | final exam Thursday, 5-7 PM, K216                                                                                       |           |

**GRADING:** exam #1 (25%), exam #2 (25%), final exam (25%), project (25%).


**PAPERS:** Listed on the reverse side.
BME 464 Medical Imaging: List of reference papers


Course Content:

BME464 Engineering and clinical applications of medical imaging systems including X-ray, computed tomography, radioisotope imaging, ultrasound, magnetic resonance imaging; picture archiving and communications system and medical image processing. (Lec. 3)

BME465 Development of medical image processing algorithms with graphical user interface in C++ under the Windows operating system: smoothing and sharpening filters, morphological filters, area measurement and edge tracer. (Lab. 3)

Objectives:

- To Understand the physics, mathematics, engineering, and clinical applications of medical imaging systems including x-rays, computed assisted tomography, angiography, gamma camera, single photon emission computed tomography, positron emission tomography, ultrasound imaging, and magnetic resonance imaging.
- To Question Think critically about design tradeoffs in medical imaging systems and computer algorithms for medical image processing, alternatives, and verification and validation methods for medical image processing algorithms.

- To Design Design and develop medical image processing algorithms for image enhancement, feature detection, automated analysis, and quantitative measurements by use of modern software development tools.

- To Communicate Improve communication skills through oral presentation and written project reports.

Outcomes:

- Demonstrate an understanding of the physics, mathematics, engineering, and clinical applications of medical imaging systems.

- Apply mathematical analyses to medical image processing problems.

- Demonstrate the proficiency of developing application software using graphical user interface under a modern C++ based software development system.

- Demonstrate the ability to design algorithms for solving specific medical image processing tasks.

- Demonstrate the ability to implement the aforementioned algorithms using the available software development tools.

- Present the completed projects in both oral and written formats.

Any student with a documented disability is welcome to contact me as early in the semester as possible so that we may arrange reasonable accommodations. As part of this process, please be in touch with Disability Services for Students Office in Memorial Union, room 330 or phone 874-2098.