Physics 318 - Biophysics and Medical Imaging

Instructor:

Dr. Steve Lindaas lindaas@mnstate.edu
Office: 307 G Hagen (218) 477-4268
Office Hours: See information on-line at http://www.mnstate.edu/lindaas

Official Course Description:
This course is a calculus-based study of biophysics and medical imaging techniques and topics covering optical microscopy, computed (axial) tomography (CT or CAT), magnetic resonance imaging (MRI), ultrasound imaging and positron emission tomography (PET). Techniques in real space and Fourier space imaging will be covered including resolution, aberrations and exposure limitations. Special attention will be given to radiation effects and nuclear medicine topics. This course will use cooperative learning techniques along with guided labs covering selected techniques.

Prerequisites:
Students need to have successfully completed PHYS 201. Students will be using algebra, trigonometry and calculus to quantify physical concepts. If you have questions about the mathematical rigor expected this semester, please speak with your instructor.

Required Texts:

- W.R Hendee and E.R. Ritenour, *Medical Imaging Physics 4th Edition*, Wiley-Liss Inc. (2002) ISBN 0-471-38226-4

Course Objectives / Student Learning Outcomes:

- Participants will become familiar with a variety of biophysics and medical imaging concepts including optical microscopy, computed tomography, magnetic resonance imaging, ultrasound imaging and positron emission tomography.
- Participants will utilize critical thinking skills.
- Participants will utilize estimating and unit analysis skills.
- Participants will participate in guided and inquiry-based experiences.
- Participants will utilize and reinforce the scientific method.
- Participants will utilize data analysis and error analysis within a laboratory experiment.

Evaluation:
Each component of the course counts as follows:

Note: It is your choice what work you complete. However, it is to your advantage to complete all work – even an incomplete assignment is better than no assignment.

		Exams	
Assignments and Activities	Participation	Tests and Quizzes	Final
40%	10%	30%	20%

Grades will be assigned on the absolute scale below; plusses and minuses will be used for the top or bottom quarter of a bracket.

A	B	C	D	F
100-90%	89-80%	79-70%	69-60%	< 60%

- **Assignments**: Biomedical problems will be assigned each week from the text. You are encouraged to work in groups, but the write-ups must be your own. You are responsible for knowing when assignments are due since late work is not generally accepted. Due dates will be posted on-line and any changes/updates posted with email notification. All the problems may be graded or more likely a subset will be graded and completeness checked.
- **Activities**: There are some laboratory activities that I would like to have you experience. To give you enough time to understand these activities we will most likely schedule times outside of the regular class. Labs will have a strong conceptual component with some quantization of observations. We also have the possibility of touring medical imaging facilities. It is anticipated that these field trips will take extra time outside of class. Every effort will be made to accommodate students' schedules so they have the opportunity to participate.
- **Participation**: You will be part of a small group that is assigned discussion questions from each chapter and lab activity. Your group will be responsible for leading the discussion of each of these questions. Expect discussion questions to varying in complexity.
- **Quizzes**: Quizzes may be given that cover readings, discussion questions, assignments, and lab activities. Lab journals/notes may be used for quizzes concerning lab activities. Hence, you are strongly encouraged to utilize good organization and experimental technique while writing in your lab notebook.
- **Exams**: Exams will consist of several questions similar to prior problems as well as questions based on your knowledge of lab activities. Partial credit will be given, but only if what you have written is logical and well organized.
- **Attendance**: Attendance at all class meetings is expected. There is a high correlation with attendance and understanding what you are doing.
- **Universal Excuse Form:** Sometimes life happens. You must use a universal excuse form if you want to:
  - turn in late assignments
  - arrange alternative test dates –preferably in advance!
  - petition to make up missed quizzes or exams
- **Academic Honesty:** Your education is only as good as your integrity. If you have any questions as to what is acceptable behavior see the instructor or review the MSUM Student Academic Policy in the Student Handbook: http://www.mnstate.edu/sthandbook/ (under Student Policy Info).

Class Schedule:

Lecture: Tuesday and Thursday	1:30 – 2:45 pm	Hagen 305
Lab Activities: Variable		
Field Trips: TBD		

Course Web Site: http://web.mnstate.edu/lindaas/ and **D2L**

This course makes extensive use of the internet to distribute course materials (assignments, solutions, etc.). If you anticipate having difficulty accessing the internet, please see Dr. Lindaas as soon as possible.

Special Accommodations:
Minnesota State University Moorhead is committed to providing equitable access to learning opportunities for all students. The Disability Resource Center (DRC) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

- If you have, or think you may have, a disability (e.g. mental health, attentional, learning, chronic health, sensory or physical) please contact the DRC at (218) 477-4318 (V) or (800)627.3529 or 711 (MRS/TTY) to schedule an appointment for an intake.

Additional information is available on the DRC website: http://www.mnstate.edu/disability/

A man brought a very limp dog into the veterinary clinic. As he lay the dog on the table, the doctor pulled out his stethoscope, placing the receptor on the dog's chest. After a moment or two, the vet shook his head sadly and said, "I'm sorry, but your dog has passed away."

"What?" screamed the man. "How can you tell? You haven't done any testing on him or anything. I want another opinion!"

With that, the vet turned and left the room. In a few moments, he returned with a Labrador Retriever. The Retriever went right to work, checking the poor dead dog out thoroughly with his nose. After a considerable amount of sniffing, the Retriever sadly shook his head and said, "Bark" (meaning "dead as a doornail").

The veterinarian then took the Labrador out and returned in a few moments with a cat, who also carefully sniffed out the poor dog on the table. As had his predecessors, the cat sadly shook his head and said, "Meow" (meaning "he's history"). He then jumped off the table and ran out of the room.

The veterinarian handed the man a bill for $600. The dog's owner went berserk. "$600! Just to tell me my dog is dead? This is outrageous!"

The vet shook his head sadly and explained. "If you had taken my word for it, the charge would have been $50, but you wanted the Lab work and the Cat scan."