

College of Engineering Standard Syllabus: ENU 6937, Fall 2005

ENU 6937 Advanced Therapeutic Radiological Physics

1. **Course Description:** Graduate course in therapeutic radiation therapy physics covering special topics targeted to those pursuing careers in radiation therapy physics. (3 Credits)
2. **Pre-requisites:** ENU 6627 and/ or permission of instructor and Medical Physics Program Coordinator.
3. **Course Objective:** The focus of this course is technology implementation and evaluation within a radiation therapy clinic with an emphasis in imaging using current AAPM Task Group reports. Topics to be covered include brachytherapy dose calculation QA, EPID technology, EPID clinical applications and QA, imaging theory, 2D image registration and fusion, 3D image registration, onboard conebeam CT (applications pending availability at SHANDS RO), introduction to IMRT and image processing (time pending). The imaging modalities used will be portal imaging, CT and MR (pending availability from SHANDS). Student projects will be designed with applications to the clinic. The students will report project progress on a weekly basis in a short question/ answer presentation format.
4. **Instructor:** *Dr. Sanjiv S. Samant*
 - a. Office location: 202 Nuclear Sciences Building
 - b. Telephone: 352-192-1401, ext 348
 - c. E-mail address: **samant@ufl.edu**
 - d. Web site: <http://www.nre.ufl.edu/>
 - e. Office hours: Mondays and Wednesdays: 9:30-11:00am
5. **Meeting Times:** UF Class Periods 10 and 11 (5:30-7:05pm)
6. **Class days:** Tuesdays and Thursdays
7. **Meeting Location:** NRE (Nuclear Sciences Bldg) NSC 227 and SHANDS Radiation Oncology
8. **Material and Supply Fees:** Covered by Tuition/Registration
9. **Textbooks and Software Required:**

AAPM Task Group Reports and photocopied material to be supplied by instructor.

MATLAB software (available free in computer labs through university wide license) and TK Problem solver (optional) for \$10 at NRE front office
10. **Additional recommended reference reading:**

Digital Image Processing Using MATLAB (Hardcover)
By Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins

Biosignal and Biomedical Image Processing: MATLAB-based Applications (Signal Processing and Communications, 22)
(eBook available from UF library) by John L. Semmlow
Publisher: Marcel Dekker, Inc, 2004, New York

Biosignal and Biomedical Image Processing: Matlab-based Applications (Signal Processing and Communications, 22) (Hardcopy version of eBook)
Hardcover: 550 pages
Publisher: CRC Press (January 1, 2004)
ISBN: 0824748034

Handbook of Medical Imaging, Volume 2. Medical Image Processing and Analysis (SPIE Press Monograph Vol. PM80) (hardcopy available at UF library)
By Jacob Beutel (editor), M. Sonka (editor)
Hardcover: 1108 pages
Publisher: SPIE-International Society for Optical Engineering (June 15, 2000)
ISBN: 0819436224

2-D and 3-D Image Registration: for Medical, Remote Sensing, and Industrial Applications (eBook and hardcopy available at UF library)
By A. Ardeshir Goshtasby
Hardcover: 280 pages
Publisher: Wiley-Interscience (February 25, 2005)
ISBN: 0471649546

Numerical Methods for Image Registration (Numerical Mathematics and Scientific Computation) (eBook and hardcopy available at UF library)
By Jan Modersitzki
Hardcover: 216 pages
Publisher: Oxford University Press (February 1, 2004)
ISBN: 0198528418

11. **Attendance and Expectations: Attendance is required.** Penalties for each unexcused absence will be at the discretion of the Professor, up to a 2% deduction in cumulative average per unexcused absence. Please make arrangements for excused absences in advance. Graded homework is due no later than 5:00pm of the due date. After that a penalty will apply to that grade. **Students will be regularly assigned mandatory prior reading as part of class preparation.**

12. **Grading:** The distribution for the grades is given below.

ASSIGNMENT	TOTAL
Homework Problem Sets & Projects	75 %
Final Exam (cumulative)	25 %
	100 %

13. **Grading Scale:** (100-86 A, 85-80 B+, 79-70 B, 69-65 C+, 64-56 C, etc) Note: grades *may* be curved.

14. **Make-up Exam Policy:** All assigned homework/ project must be completed. Extensions may only be given at the discretion of the instructor for *excused* absences. There are **no** make-up assignments; *excused* absences will permit points from missed graded events to be credited as a percentage of the Final Exam Grade. Unexcused absences will result in a zero on the missed graded event.
15. **Honesty Policy** – All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work, and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.
16. **Accommodation for Students with Disabilities** – Students requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.
17. **UF Counseling Services** – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
 - University Counseling Center, 301 Peabody Hall, 392-1575, Personal and Career Counseling.
 - SHCC mental Health, Student Health Care Center, 392-1171, Personal and Counseling.
 - Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, sexual assault counseling.
 - Career Resource Center, Reitz Union, 392-1601, career development assistance/ counseling.
18. **Software Use** – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

TOPICS COVERED

- I. Dose calculation in brachytherapy and treatment planning QA
- II. Portal imaging systems: description of current clinical systems
- III. Role of electronic portal imaging devices (EPIDs) in clinic, QA and hands on lab at SHANDS Radiation Oncology
- IV. Imaging theory: contrast, quantum efficiency (QE), modular transfer function (MTF), noise power spectrum (NPS), detective quantum efficiency (DQE)
- V. Image registration: classification (point, surface, and intensity based), transformations and quantifications of registration accuracy
- VI. Intensity based image registration: similarity measures, optimization and visualization
- VII. 3D image registration (CT, MR) and pending availability) hands on lab at UF Brain Institute
- VIII. Linac based conebeam CT in the clinic (hands on lab pending availability at SHANDS Radiation Oncology)
- IX. Intensity modulated radiation therapy (IMRT) (hands on lab pending availability at SHANDS Radiation Oncology)
- X. Image processing (time pending)