**University of Toledo**
**Department of Physics and Astronomy**

**Course Number:** **Phys 4430**
**Course:** **Medical Physics I**
**Course Description:** This course provides an overview of the physical principles and instrumentation of the major medical imaging modalities including projection radiography, and computed tomography. In addition the course will present a general prospective on use of radiation in cancer treatment including discussions on basic conventional radiotherapy, advanced image guided radiotherapy and treatment planning.

**Course Schedule:** **Tuesdays 9:30 – 12:00**
**Credits:** 3 credit hrs
**Instructors:** Drs. Parsai, Shvydka, Pearson, Sperling, and Krugh.
**Prerequisite:** Consent of the primary instructors

**Course Objectives:** Upon completion of the course, the student will:

1. Have an understanding of the basic physical principles of x-ray production, radioactivity and radionuclide production, and the interaction of radiation with matter.
2. Understand characteristics of digital images including aspects of image quality such as spatial resolution, contrast, noise, and artifacts.
3. Have developed an understanding of the basic instrumentation and processes for image formation in projection radiography, and computed tomography.
4. Understands the applications of imaging in radiotherapy
5. Will learn about treatment of cancer patients through external beam radiotherapy and the extensive related physical concepts in calculation of radiation dose to targeted volumes, as well as techniques to spare the healthy normal tissue through intensity modulated radiotherapy.
6. Will develop an understanding of advanced techniques such as IGRT and Inverse Planning in radiotherapy applications.

**Required Text:** Hendee & Rietnouir, Medical Imaging Physics, 4th Edition
**Supplemental Text:** Pawlicki, Scanderbeg, Starkschall, Hendee's Radiation Therapy Physics, 4th edition (available online through UT library)
**Grading:** The grade will be based on results of Mid-term and Final exams

**Course Calendar:**

| **Week/Date:** | **Topic:** | **Instructor** |
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| Week 1 **(8/29)** | Basic physics of radiation | EP |
| Week 2 **(9/5)** | Machines for producing radiation | DP |
| Week 3 **(9/12)** | Measurement of ionizing radiation | DS |
| Week 4 **(9/19)** | Digital images and aspects of image quality | KK |
| Week 5 **(9/26)** | X-ray tubes and x-ray production | DS |

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| Week 6 **(10/3)** | Projection radiography | KK |
| Week 7 **(10/10)** | Computed tomography | KK |
| **(10/17)** | **FALL BREAK** | |
| Week 8 **(10/24)** | **MIDTERM EXAM** | |
| Week 9 **(10/31)** | The Physical and Biological Basis of Radiation Oncology | EP |
| Week 10 **(11/7)** | Calibration of Megavoltage beams of X-rays and electrons | DP |
| Week 11 **(11/14)** | External beam dose calculation for photon and electrons | DP |
| Week 12 **(11/21)** | External beam treatment planning and delivery | NS |
| Week 13 **(11/28)** | Tumor targeting, image guided and adaptive radiotherapy | NS |
| Week 14 **(12/5)** | Radiation Oncology Informatics | NS |
| Week 15 **(12/12)** | **FINAL EXAM** | |