Syllabus for Radiological Physics and Dosimetry PHYS 634/459 Fall 2018

Class Room: Room 237, Physics Conference room
Meeting Time : Mon. and Wed, 6:30pm-7:45pm
Instructor: G. Coutrakon, email: gcoutrakon@niu.edu
Course Materials: Faiz Kahn, "The Physics of Radiation Therapy"
and Top Hat. Sign up at www.tophat.com . Course number is 768407
Additional reading materials on Black Board. Home work will be assigned with questions posted on Black Board.

Office hours: Mon. and Wed. 1:00pm-2:00pm and Fridays at 3pm by request
Office Location : Room 218 Faraday Hall

Grading for the course

The course grade will consist of graded HW assignments, approximately 8 for the Semester, short multiple choice quizzes on Top Hat, one midterm exam and a final exam. The weighting will be 50% for HW, 10% quizzes, 20% for the mid term exam, and 20% for final exam. Grades will be determined from the Weighted Total column in Black Board and by the instructor's review of the spectrum of Weighted Total scores. Attendance and completion of HW will be important in evaluating the final grade. Undergraduates (in Phys 459) may have a more generous grading curve than graduate students when assigning the final grade, but the assignments will be the same. There will be a midterm grade given to each student in the 9th or 10th week.

Week 1 & Week 2	Interactions of X-rays in matter (10 keV to 20 MeV) Generators for diagnostic and therapeutic x-rays (50KeV-20 MeV) Relativistic kinematics and energy units for charged particles Interactions of charged particle beams in matter, Bethe Bloch Eqn. Reading Ch 3 and 5, Faiz Khan
Week 3	Definitions and derivations of exposure for X-rays, Kerma and absorbed dose from photon fluence. Chapter 6 and Chapter 7
Week 4 & Week 5	Bragg-Gray cavity theory and measurement of dose with air ionization chambers. The depth vs. dose curves for X-rays and charged particles in water. Reading in Faiz Khan, Sections 8.1-8.4.
Week 6 &Week 7	Relativistic kinematics for electron and proton therapy beams, Bethe-Block (energy loss) equation for electrons and protons, Janni tables for proton range and energy loss Particle range calculations in water for electrons (1 to 20 MeV), protons (50-250 MeV), and heavier ions, (100 – 400 meV/amu). electron(Ch 14.1 – 14.4) and proton depth vs. depth curves for megavoltage proton beams (Ch. 27)

Week 8 & 9	Mid Term Exam plus Chapter 9 and 10 - A system of Dose Calculations, TMR, TAR, Percent depth dose (PDD) Inverse square correction to depth vs. dose curves, monitor unit calculations
Week 10	Treatment planning and dose distributions for cancer and normal tissues. Dose Volume Histograms and Normal tissue Complication Probability (NTCP)
Week 11	Radiation biology: Cell survival curves; cell survival vs. dose for tumor cells and normal tissues. Linear Energy Transfer and Relative Biological Effectiveness (RBE), reading Ch. 17 John and Cunningham, The Physics of Radiology. Dose fractionation Schedules.
Week 12	Radiation biology - Normal Tissue dose tolerances, Cellular and tissue response to radiation. Tumor Control Probability (TCP), radiation toxicity- Normal Tissue Complication Probability (NTCP).
Week 13	Intensity Modulated (x-ray) Radiation Therapy (IMRT), Ch. 20.
Week 14	IMRT-- Continued
Week 15	Review for final exam