



Physics 535 Syllabus

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Required text: none

References:

1. AAPM TG-71: Monitor unit calculations for external photon and electron beams. (AAPM Report # 258)
2. AAPM TG-114: Verification of monitor unit calculations for non-IMRT clinical radiotherapy. (AAPM Report # 114)
3. AAPM TG-70: Recommendations for clinical electron beam dosimetry (AAPM Report # 99)
4. AAPM TG-43 Update: A revised AAPM protocol for brachytherapy dose calculations (AAPM Report #84)
5. AAPM HEBD Working Group: Dose Calculation for Photon-Emitting Brachytherapy Sources with Average Energy Higher than 50 keV. (AAPM Report #229)

These and additional related reports may be found at: <https://www.aapm.org/pubs/reports/>

6. The Physics of Radiation Therapy, 3rd or 4th Edition, Faiz M. Khan, Lippincott, Williams and Wilkins, 2003 or 2009
7. Handbook of Radiotherapy Physics: Theory and Practice. Philip Mayles, Alan Nahum, Jean-Claude Rosenwald, eds. Taylor and Francis, 2007.
8. The Physics of Radiology, 4th Edition, Harold E. Johns and John R. Cunningham, Charles C Thomas Publishers, 1983

Evaluation:

Assignments - 70%

Final Exam- 30%

Physics 535 Course Outline

1. Introduction to radiation therapy treatment planning and delivery
 - the radiation therapy process: treatment planning and delivery
 - patient immobilization and set-up techniques
 - patient data acquisition
 - definition of target and organs at risk
 - verification of target localization and dose delivered
2. External beam photon and electron dose calculations
 - properties of therapeutic photon and electron beams
 - beam data: acquisition and format for patient dose calculations
 - single beam dose calculations in a flat, homogeneous medium
 - dose calculations on the central beam axis
 - off-axis dose calculations
 - dose calculation in the presence of irregular surfaces, oblique incidence, and inhomogeneities
 - correction-based methods
 - model-based algorithms
 - Monte Carlo and Grid-based Boltzmann solver methods
3. Single and multiple beam treatment planning
 - multiple beam arrangements and their application
 - coplanar and noncoplanar intersecting beams
 - adjacent beams
 - beam weighting in patient dose calculations
 - beam modification
 - aperture shaping
 - intensity or fluence modulation
 - surface modification: bolus
 - optimization of beam parameters
 - forward planning
 - inverse planning
4. Brachytherapy
 - techniques: surface, intracavitary, interstitial
 - radioactive sources and delivery apparatus
 - dose rate
 - dose calculations
 - fundamentals of treatment planning
5. Special techniques
 - proton beam therapy
 - moving beam therapy (photon and electron arcs, linear scanning)
 - total body photon and electron irradiation
 - stereotactic radiotherapy / surgery (linac, cyberknife, gamma knife)
 - tomotherapy
 - motion management: gating, coaching, and breath hold techniques
6. Clinical application of imaging technologies in radiation therapy
 - CT and conventional simulation
 - MRI, PET, and ultrasound imaging in treatment planning and delivery
 - image fusion, registration, and deformation
 - 4D CT
 - kV and MV portal imaging
 - kV and MV cone beam CT
7. Radiation therapy errors: lessons to be learned