Virginia Western Community College
ROC 241
Radiation Therapy Physics II

Prerequisites
ROC 141

Course Description
Studies methods and devices used for measurement of and protection from ionizing radiation. Various types of brachytherapy applicators and dose distribution systems will be discussed. Electron beam dosimetry will be introduced. The physics component of quality assurance in radiation oncology will be discussed as well as various treatment methods.

Semester Credits: 2 Lecture Hours: 2 Lab/Clinical/Internship Hours: 0

Required Material:
A scientific calculator is required.

McDerrmott, P. and Orton, C. (2010). *The physics and technology o fradiation therapy.* Medical Physics Publishing. ISBN-13: 978-1-930524-32-3

Course Outcomes

At the completion of this course, the student should be able t

- Discuss radiation safety and protection.
- Examine different methods and equipment used to measure ionizing radiation.
- Describe the relationship between beam energy, its penetration, absorption, and scatter.
- Describe the method of brachytherapy including source selection, source placement, and calculations for permanent and temporary implants.
- Discuss the relationship between x-ray beam quality and the half-value layer.
- Describe the interactions of electrons in matter and the characteristics of clinical electron beams.
- Discuss quality assurance in radiation oncology physics.
- Examine different treatment methods currently being used in radiation oncology

Topical Description

Basic Physics Review:

- Attenuation of Ionizing x & gamma radiation
  - Linear Attenuation coefficient
  - Mass Attenuation coefficient
- Interaction of Radiation and matter
  - Photoelectric effect
  - Compton Interactions
  - Pair Production
- Radioactivity
  - Modes of Decay
    - Alpha
    - $Beta^-$ /$Beta^+$
    - Electron Capture
    - Internal Conversion
    - Auger

- Types of Radiotherapy Machines:
  - Contact therapy
  - Superficial Therapy
  - Orthovoltage
  - Co^{60}
  - Super-voltage
    - Van-de-Graaff
    - Linear Accelerators
    - Betatron
    - Introduction to Proton Unit
- Design and Operation of Modern day Medical Linear Accelerator
  - RF Generation
  - Wave Guide Design
  - Accelerator Structure
  - Bending Magnet
  - Beam Steering
  - Target operation
  - Scatter foil design and applications.
- Performance of Radiotherapy Unit
  - Measurement of Energy
  - Beam Flatness
  - Beam Symmetry
  - Penumbra
  - Geometric Isocenter Verifications
- Absolute Dose Measurement

    - Concept of air ionization chamber
    - Review of Calibration Protocols
        - TG-26
        - TG-51
        - TG-142
- Physics of Electron Beams
    - Define Charged Particle Therapy
    - Beam Energy Definition
        - Electron Range
        - Bremstralung contamination
    - Beam Profiles
- Bracheytherapy
    - Description of Sources
        - Ra^{226}
        - Cs^{137}
        - Ir^{192}
    - Source Calibration Protocols
    - Paterson-Parker distribution Laws
        - Planar
        - Volume
    - HDR
        - Source strength
        - Delivery
        - Dwell Times
        - Calibration technique
        - SAFETY