MD 4300: Introduction to Medical Dosimetry
(3semester hour)
Course Syllabus for Fall 2009

Instructors: Mahsa Dehghanpour, M.S., CMD
Jane Chapman, MEd, CMD
Faye Bryan, BA., RTT, CMD
Medical Dosimetrists

Office hours: Monday-Friday: 8:00AM-5:00PM by appointment

Contact Information: Mahsa Dehghanpour: mdehghan@mdanderson.org
Phone: (713) 792-3455
Fax: (713) 745-3337

Time/Days: See schedule

Location: Y2.6013

Class handouts

Prerequisite: Admission to the program

Course Link: http://www.medicaldosimetry.org/
http://www.aapm.org/

Course Description:
This course will define radiation, introduce dosimetry parameters, outline radiation physics terminology, and present basic calculations as will be expected in the clinical setting. There will be a basic math review and lectures detailing clinical duties. The students will be instructed in the day to day duties of the clinical dosimetrist such as estimating effective field size, checking charts, ascertaining match between prescription and chart dosing, electronic charting, and performing dosimetry calculations.
Each student will be required to develop a presentation about a particular area of treatment planning. The student will present a power point slide show outlining a disease/disease site (ie breast cancer, lymphoma, etc.), typical radiation treatment for the area, and some aspects of treatment planning. Treatment planning lectures will cover isodose distributions and what can be done to shape them as desired; as well as site specific treatment planning tips.
MD 4300: Introduction to Medical Dosimetry  
Course Calendar for Fall 2009

Aug27, Thursday
8:30am-11:30am Welcome to Medical Dosimetry  
Introduction of the instructor  
Introduction of participants  
Review of course syllabus  
Students’ pictures are taken

“Radiation Physics Terminology” Lecture (Jane Chapman, MEd., CMD)  
Introduction to terms and concepts used widely in Medical Dosimetry

1pm-4pm Discussion about the expectations of Medical Dosimetry students (Mahsa Dehghanpour, MS., CMD)  
Program faculty will go over the program Student Guide

4pm-5pm Purchase lab coats  
Students are required to purchase lab coats to be worn the next day, students are given the program specific patches to attach to their lab coat

Aug28, Friday
9am-noon Dosimetry tour/Machine demonstration  
Students meet in the class. A Medical Dosimetrist from clinic comes and takes all the students to the dosimetry area and introduces them to the personnel. S/he also takes students for a tour in the radiation treatment areas. One of the radiation therapists performs a linear accelerator demonstration to introduce students to the linear accelerator and all the accessories.

Sep2, Wednesday
1pm-4pm Exam over the “Radiation Physics Terminology” Math Review lecture (Mahsa Dehghanpour, MS., CMD)  
In this math review, students refresh their math knowledge and learn the applications of math in medical dosimetry. This lecture will cover all the math skills they need to perform their dosimetric duties.

Sep3, Thursday
9:30am-12:30pm “Math” exam
“Power Point” presentation (*Mahsa Dehghanpour, MS., CMD*)

Each Student will be assigned to a presentation topic which is a disease site.
Students will research about their assigned topic and produce a power point presentation to present at the end of this course.
Instructor will teach students how to produce a power point presentation and give them time in the class to practice.

**Sep4, Friday**
8:30am-11:30am  “SSD Calculation” lecture (*Mahsa Dehghanpour, MS., CMD*)

Student interviews (*Mahsa Dehghanpour, MS., CMD*)

Faculty will schedule the students’ time of interview. Each student will meet the faculty (Mahsa Dehghanpour) at her office YB 5820.
Faculty will go over the students’ degree plan and interview them about their perspective of the program and profession individually.

**Sep9, Wednesday**
1pm-4pm  ADAC training (*Faye Bryan, BA., RTT, CMD*)
Students learn the skills necessary in outlining critical structures on the treatment planning computer.
Students are given time to practice in the class in small groups.

**Sep10, Thursday**
9:30am-12:30pm  “SSD Calculation” review for exam (*Mahsa Dehghanpour, MS., CMD*)
Instructor will review the SSD calculation to prepare students for the exam

**Sep11, Friday**
8:30am-10am  Exam over “SSD Calculation”

10am-11:30am  “SAD Calculation” lecture (*Mahsa Dehghanpour, MS., CMD*)

1pm-4pm  Clinical Calculation Demo
Students will go to the clinic and one of the dosimetrists will demonstrate how to use Diamond software to perform verification calculation.
**Sep16, Wednesday**

1pm-4pm  ADAC training *(Faye Bryan, BA., RTT, CMD)*

Students are introduced and learn many functions in ADAC system of treatment planning including:
- How to login to the Pinnacle, open /copy a patient plan
- How to open “Smart Sim” window
- How to setup the beam (remove the couch and localize the lasers)
- How to add/copy a beam
- How to add a block
- How to add/edit a prescription
- How to add a “Dose Grid”
- How to add isodose lines
- How to select the Reference Point in Monitor Units window
- How to calculate beams
- How to adjust beam weightings
- How to add a wedge
- What is the appropriate beam engine for dose calculation
- How to add/copy another trial for your plan
- How to create DVH
- How to create Multi-Paned Window

Students are given time to practice in the class in small groups

**Sep17, Thursday**

9:30am-12:30pm  “SAD Calculation” lecture and review *(Mahsa Dehghanpour, MS., CMD)*

Instructor will finish the lesson and give time for students to practice SAD calculation problems in the class to prepare for the exam

**Sep18, Friday**

8:30am-10am  “SAD Calculation” Exam

10am-11:30am  “Hand Calculation” demonstration
  A Medical Dosimetrist will go over the hand calculation technique for dose verification

1:30am-4:30pm  “Simulation/AcQsim” demonstration
  Students go to the clinic and one of the medical dosimetrists will demonstrate patient simulation/AcQsim

**Sep21, Monday**

8:30am-10:30am  “Hand Calculation” *(Mahsa Dehghanpour, MS., CMD)*

Students are given different cases to practice hand calculation in the class. Instructor facilitates this process.
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>10:30am-11:30am</td>
<td>“Treatment Planning” Lecture <em>(Faye Bryan, BA., RTT, CMD)</em></td>
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<td>Instructor go over typical techniques of treatment planning</td>
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<td><strong>Sep23, Wednesday</strong></td>
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<tr>
<td>1pm-4pm</td>
<td>ADAC training <em>(Mahsa Dehghanpour, MS., CMD)</em></td>
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<td>Instructor demonstrates “step and shoot” and “field in field” technique in treatment planning used to reduce the hot spots.</td>
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<td><strong>Sep24, Thursday</strong></td>
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<tr>
<td>9:30am-10:30am</td>
<td>Proton Lecture <em>(Beverly Riley, CMD)</em></td>
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<tr>
<td>10:30am-12:30pm</td>
<td>Students’ presentation</td>
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<td>Students present their cases using power point. Each student has about 20 minutes to present.</td>
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<td><strong>Sep25, Friday</strong></td>
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<tr>
<td>8:30am-12noon</td>
<td>Students’ presentation</td>
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<tr>
<td></td>
<td>Students present their cases using power point. Each student has about 20 minutes to present.</td>
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<tr>
<td>1:00-2:00pm</td>
<td>Proton Lecture <em>(Cody Crawford, CMD)</em></td>
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<td>2:00pm-3:00pm</td>
<td>“Clinical Issues” <em>(Mahsa Dehghanpour, MS., CMD)</em></td>
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<td>Students start their clinical education on Sep 28th. The clinical circumstances are new for most of the students and are different from their previous education in colleges or universities. Clinical instructors’ expectations of students will be discussed.</td>
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<td>3:00pm-5:00pm</td>
<td>“Meeting with team leaders”</td>
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<td>Students go to the clinic to have a group meeting with administrators and all the team leaders. Clinical instructors’ expectation of students will be discussed by team leaders. Location TBA</td>
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**Grading Policy**

The course grade will be determined according to the following:
<table>
<thead>
<tr>
<th></th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Exam 1: Math Review</td>
<td>20%</td>
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<tr>
<td>Exam 2: Definitions and Terms</td>
<td>20%</td>
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<tr>
<td>Exam 3: SSD Calculations</td>
<td>25%</td>
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<tr>
<td>Exam 4: SAD Calculations</td>
<td>25%</td>
</tr>
<tr>
<td>Student Presentation</td>
<td>10%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
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The exams will include: multiple choice, fill in the blank, matching, and calculations. The following grading guidelines will be utilized:

A = 100 – 90%
B = 89 – 80%
C = 79 – 75%
F < 75%

Course Outline

I. Define Radiation
   A. Electromagnetic radiation
   B. Therapeutic radiation

II. Radiation Physics/Dosimetry Terminology
   A. Treatment Terms
      1. Beams: electron, photon, beam energy
      2. Machines: Cobalt, linac simulator
      3. Set-up parameters: SSD, SAD, ODI, gantry angle, etc.
      4. Monitor units/Set time
      5. Field size and shaping: collimation, blocking, skin collimation, etc
   B. Calculation Parameters
      1. Depth attenuation: PDD, TAR, TMR
      2. Scatter: BSF, PSF
      3. Electronic Equilibrium: \( d_{\text{max}} \)
      4. Accessory attenuation: tray factor, wedge factor, etc.
      5. Factors: OAF, FSD, OPF, etc.
      6. Isodose curves and distributions
      7. Weighting

III. Math Review
   A. Geometry
      1. Angles
      2. Angle pairs
      3. Triangles
      4. Applications
   B. Trigonometry
      1. Trigonometric functions
      2. Application
   C. Formulas
      1. Area
2. Perimeter
3. Volume
4. Application

D. Cartesian Coordinate System
   1. Coordinates of a point
   2. Pythagorean theorem
   3. Application

E. Functions
   1. Domain and Range
   2. Variable
   3. Graphing
   4. Linear functions
   5. Equations
   6. Intercepts
   7. Asymptotes
   8. Slope
   9. Inverse functions

F. Exponents
   1. Notation
   2. Properties
   3. Logarithms
   4. Scientific notation
   5. Natural Log

G. Interpolation

IV. Dosimetry Calculations
   A. SSD Calculations
   B. SAD Calculations

V. Treatment Planning
   A. Isodose chart
   B. Shaping Isodose distributions
   C. Calculation Points
   D. Dose Volume Histograms

Course Objectives

The student will be able to:

1. Define radiation with familiarity of electromagnetic radiation and X-rays.
2. Discuss radiation beams commonly used for therapeutic radiation.
3. Identify the various radiation producing treatment units used in radiotherapy
4. Explain the terms associated with patient set-up
5. Understand the relationship between machine setting and beam on time
6. Demonstrate knowledge of field size and field shaping
7. Identify and discuss factors for dose calculation such as depth attenuation factors, scatter factors, field size, accessory attenuation
8. Define electronic equilibrium and its relationship to skin sparing
9. Understand and identify isodose curves and distributions
10. Describe weighting and perform related calculations
11. Discuss the clinical duties of a medical dosimetrist
12. Estimate effective field size
13. Perform prescription to dose per fraction per field calculations
14. Look up parameters using table and graphs
15. Interpolate to achieve the appropriate parameter
16. Use formulas such as appear on hand calculation sheets
17. Perform the calculation indicated by the formulas
18. Outline structures on the treatment planning computer
19. Create a simple plan on the treatment planning computer

Course Approval date: July 2000
Course last review and revision date: July 2009