New Course Request

Indiana University

TUPUI Campus

Check Appropriate Boxes: Undergraduate credit □ Graduate credit [X] Professional credit □

1. School/Division ____________________________ 2. Academic Subject Code ____________________________
   School of Medicine RAON

3. Course Number ____________________________ 4. Instructor ____________________________
   D 605 (must be cleared with University Enrollment Services) Colleen Deskisers,

5. Course Title ____________________________
   Medical Physics for Radiation Oncology II

   Recommended Abbreviation (Optional) Med Phys for RadOnc II
   (Limited to 32 Characters including spaces)

6. First time this course is to be offered (Semester/Year): Fall Semester 2010

7. Credit Hours: Fixed at ______ or Variable from ______ to ______

8. Is this course to be graded S-F (only)? Yes ___ No [X]

9. Is variable title approval being requested? Yes ___ No [X]

10. Course description (not to exceed 50 words) for Bulletin publication:

    The second portion of Medical Physics for Radiation Oncology addresses the physics
    considerations for measurement of absorbed dose, dose distributions, dosimetric
    calculations, treatment planning for photons, electrons and brachytherapy and other
    advanced planning topics as well as quality assurance from the physicist point of view.

11. Lecture Contact Hours: Fixed at ______ or Variable from ______ to ______

12. Non-Lecture Contact Hours: Fixed at ______ or Variable from ______ to ______

13. Estimated enrollment: ______ of which ______ percent are expected to be graduate students.

14. Frequency of scheduling: ______ Will this course be required for majors? Yes certificate program

15. Justification for new course: ____________________________
   Development of new certificate program in medical dosimetry

16. Are the necessary reading materials currently available in the appropriate library? Yes [X]

17. Please append a complete outline of the proposed course, and indicate instructor (if known), textbooks, and other
   materials.

18. If this course overlaps with existing courses, please explain with which courses it overlaps and whether this overlap is
    necessary, desirable, or unimportant.

19. A copy of every new course proposal must be submitted to departments, schools, or divisions in which there may be
    overlap of the new course with existing courses or areas of strong concern, with instructions that they send comments
    directly to the originating Curriculum Committee. Please append a list of departments, schools, or divisions thus
    consulted.

Submitted by:

[Signature]  Date 7/14/10

Department Chairman/Division Director

Date

Dean of Graduate School (when required)

Approved by:

[Signature]  Date 7/21/09

Dean

Chancellor/Vice-President

Date

University Enrollment Services

Date

After School/Division approval, forward the last copy (without attachments) to University Enrollment Services for initial processing, and the remaining four copies and attachments to the Campus Chancellor or Vice-President.

UPS 724

University Enrollment Services Final—White; Chancellor/Vice-President—Blue; School/Division—Yellow;
Department/Division—Pink; University Enrollment Services Advance—White
NEW COURSE REQUEST

I. Title: Medical Physics for Radiation Oncology II
   Course #  RAON-D605
   Course Director: Colleen DesRosiers, Ph.D.
   Course Instructor: Colleen DesRosiers, Ph.D., et al.
   Prerequisites: Completion of RAON-D604

   Suggested Course Abbreviation: Med Phys for RadOnc II
   Fall Semester  2 credit hours  2 hrs/week (15 wks)(60 min) = 1800 minutes

II. Course Description and Rationale
   The second portion of Medical Physics for Radiation Oncology addresses the physics
   considerations for measurement of absorbed dose, dose distributions, dosimetric
   calculations, treatment planning for photons, electrons and brachytherapy and other
   advanced planning topics as well as quality assurance from the physicist point of view.

   The course is not only important for the medical physicist but also for the medical dosimetrist
   who will need to apply physics concepts in the execution of their dosimetry tasks.

III. Educational Objectives
   Upon completion of this course the student will be able to:
   1. Describe the methods of measuring ionizing radiation
      a. Define exposure, absorbed dose, attenuation coefficient, mass attenuation
         coefficient
      b. Define particle fluence and energy fluence
      c. Describe the free-air ion chamber
      d. Describe qualitatively and graphically the concept of electronic equilibrium

      Assessment: Written homework based on lecture, review of text, to be reviewed and
      graded by a physicist.

   2. Know how the quality of an x-ray beam is measured and defined.

      Assessment: Written homework based on lecture, review of text, review of measured data.
      Homework to be reviewed and graded by a physicist.

   3. Describe the instrumentation used for measuring ionizing radiation
      a. Gas-filled detectors
      b. Ion chambers
      c. Film
      d. Thermoluminescent dosimetry
      e. Diode dosimetry
      f. Calorimetry
g. Chemical dosimetry

Assessment: Written homework based on lecture, review of text, some hands on experience with survey meters, ion chambers, film dosimetry. Homework to be reviewed and graded by a physicist.

4. Describe absorbed dose calibration
   a. Bragg Gray Cavity Theory
   b. TG-21 and TG-51 protocols
   c. Correction factors
      i. Temperature/pressure
      ii. Ionization recombination
      iii. Polarity
      iv. Chamber replacement

Assessment: Written homework based on lecture, review of text, review of published protocols. Homework to be reviewed and graded by a physicist.

5. To define parameters for radiation therapy MU calculations
   a. PDD/TMR/TPR/TAR
   b. Distance relationship
      i. Off axis
      ii. From source
   c. Field size and shape
   d. Output calibration
   e. Collimator scatter factor
   f. Phantom scatter factor
   g. Wedge effects
      i. Transmission factor
      ii. Off axis corrections
   h. Patient thickness relationship

Assessment: Written homework based on lecture, review of text. The homework will test the student’s ability to use empirical tables to perform patient specific practice calculations. Homework to be reviewed and graded by a physicist.

6. Describe how isodose curves are generated
   a. Describe water phantom measurements
   b. Understand the limitations of the calculations based on the semi-empirical calculation
   c. Describe how patient size and shape are corrected for in the planning system

Assessment: Written homework based on lecture, review of text, to be reviewed and graded by a physicist. Student will have the opportunity to observe and participate in water phantom measurements with a physicist.

7. Describe the processes and limitations of the patient input data
   a. Describe the different types of imaging available and its limitations
b. Describe the pre-treatment planning procedures
   c. Describe the different types of corrections made to the patient input data by the treatment planning system
      i. Heterogeneity corrections
      ii. Contour corrections

Assessment: Written homework based on lecture, review of text, to be reviewed and graded by a physicist. Review of this topic will reinforce and expand upon concepts learned in RAON D602.

8. Define electron beam interactions

Assessment: Written homework based on lecture, review of text, to be reviewed and graded by a physicist.

9. Characterize electron beams in radiation therapy
   a. Draw electron beam profiles for various energies
   b. Illustrate dose distributions when considering various patient contours
   c. Describe methods of treatment delivery for unique electron beam therapy applications

Assessment: Written homework based on lecture, review of text, review of measured data. Homework to be reviewed and graded by a physicist.

10. Describe how and why Brachytherapy is used in radiation therapy
    a. Define sources, energies, half lives, applications
    b. Compare and contrast HDR vs. LDR techniques
    c. Describe in detail prostate Brachytherapy, partial breast Brachytherapy, cervix Brachytherapy

Assessment: Written homework based on lecture, review of text, review of Brachytherapy plans and treatments. Homework to be reviewed and graded by a physicist.

11. Describe the quality assurance tests performed daily, monthly, annually and for beam commissioning of a linear accelerator.

Assessment: Written homework based on lecture, review of text, to be reviewed and graded by a physicist. Student will observe/perform QA tests with physicist on linear accelerator.

12. Understand the rationale for performing 3D vs. 2D planning vs. IMRT, distinguish between the different types and the advantages and disadvantages of each

Assessment: Written homework based on lecture, review of text, to be reviewed and graded by a physicist.

13. Describe the different techniques for performing TBI.
Assessment: Written homework based on lecture, review of text, to be reviewed and graded by a physicist. Student will learn in detail the translating table treatment technique as performed at Indiana University.

14. Understand the goals and objectives for TBI treatment.

Assessment: Written homework based on lecture, review of text, review of AAPM publication. Homework to be reviewed and graded by a physicist.

15. Describe the Monte Carlo method for calculating dose
   a. Define the requirements of performing a Monte Carlo calculation
   b. Understand the input for performing the MC calculations and the limitations of the accuracy of the results based on the input.
   c. Describe the components of a Monte Carlo code

Assessment: Written homework based on lecture, review of text, to be reviewed and graded by a physicist.

16. Describe the differences between standard therapy and stereotactic therapy
   a. Discuss the rationale for stereotactic treatment
   b. Describe advantages and disadvantages
   c. Describe the differences in treatment delivery and accuracy

Assessment: Written homework based on lecture, review of text, to be reviewed and graded by a physicist.

IV. Course Content – Syllabus

Course content will be based on the text, The Physics of Radiation Therapy by Faiz M. Khan.

1. Measurement of Ionizing Radiation
   Khan, Chapter 6 (homework = 3% total grade)

2. Quality of X-ray Beams
   Khan Chapter 7 (homework = 1% total grade)

3. Measurement of Absorbed Dose
   Khan Chapter 8 (homework = 3% total grade)

4. Dose Distribution and Scatter Analysis
   Khan Chapter 9 (homework = 3% total grade)

5. A System of Dosimetric Calculations
   Khan Chapter 10 (homework = 3% total grade)

6. Treatment Planning I – Isodose Distributions
   Khan, Chapter 11 (homework = 3% total grade)
7. Treatment Planning II – Patient Data (imaging, corrections, setup)  
   Khan, Chapter 12 (homework = 3% total grade)

8. Treatment Planning III  
   Khan, Chapter 13 (homework = 3% total grade)

9. Electron Beam Therapy  
   Khan, Chapter 14 (homework = 3% total grade)

10. Brachytherapy – conventional, prostate, HDR  
    Khan, Chapter 15, Chapter 22, Chapter 23 (homework = 3% total grade)

11. Quality Assurance  
    Khan, Chapter 17 (homework = 3% total grade)

12. 3-D Conformal / IMRT planning  
    Khan, Chapters 19-20 (homework = 1% total grade)

13. Total Body Irradiation  
    Khan Chapter 18 (homework = 1% total grade)

13. Monte Carlo Introduction  
    Selected excerpts from the following texts:  
    (homework = 1% total grade)

15. Stereotactic Radiosurgery  
    Khan, Chapter 21  
    (homework = 1% total grade)

V. Required and Recommended Texts  
   The Physics of Radiation Therapy; Khan, Faiz M.

VI. Evaluation and Grading

This didactic course will be evaluated on the basis of 3 scheduled exams, 2 lower weighted exams (20% each), a final exam (25%) and homework assignments (35%, weighting given in content section).

The Indiana University grading scale will be applied.

VII. Cheating and Plagiarism:  
Students are instructed to make themselves aware of University regulations concerning plagiarism, the maintenance of academic honesty and the definitions of unacceptable
behavior and cheating. Academic misconduct of any sort will not be tolerated and will be dealt with as outlined in the **IU/PUI Code of Student Rights, Responsibilities, and Conduct**, which can be viewed at:

http://www.iupui.edu/code/

Examples of misconduct include but are not limited to:

1. **Cheating**
   A student must not use or attempt to use unauthorized assistance, materials, information, or study aids in any academic exercise.

2. **Fabrication**
   A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citations to the sources of information.

3. **Plagiarism**
   A student must not adopt or reproduce ideas, words, or statements of another person without appropriate acknowledgment. A student must give credit to the originality of others and acknowledge an indebtedness whenever he or she does any of the following:
   a. Quotes another person’s actual words, either oral or written.
   b. Paraphrases another person’s words, either oral or written.
   c. Uses another person’s idea, opinion, or theory, or
   d. Borrows facts, statistics, or other illustrative material, unless the information is common knowledge.

4. **Interference**
   a. A student must not steal, change, destroy, or impede another student’s work.
   b. A student must not give or offer a bribe, promise favors, or make threats with the intention of affecting a grade or the evaluation of academic performance.

**Potential consequences for academic misconduct:**

If the instructor has information that one of his/her students committed an act of academic misconduct, the faculty member will hold an informal conference with the student. The conference will be prompt and private. If the faculty member concludes that the student is responsible for the misconduct, then the faculty member will impose an appropriate academic sanction (i.e., lower or failing grade on the assignment, assessing a lower or failing grade for the course).

**VIII. Americans with Disabilities Act:**
If you need any special accommodations due to a disability, please contact Adaptive Educational Services at (317)-274-3241. The office is located in CA 001E.