



## MEDICAL PHYSICS I

The University of Toledo

Department of Physics and Astronomy/Department of Radiation Oncology (CNSM/COMLS)

PHYS 4430, CRN#52126

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|--------------------------|---|------------------------|---|
| <b>Instructors:</b>      | D. Shvydka; E.I.Parsaj; S. Aldoohan;<br>D. Pearson; N. Sperling | <b>Offered:</b>        | Fall, 2020  |
| <b>Email:</b>            | Diana.Shvydka@utoledo.edu                                       | <b>Course Website:</b> | <a href="#">Blackboard Learn</a>                        |
| <b>Office Hours:</b>     | By appointment  | <b>Class Location:</b> | Ruppert HC, suit K#0005/<br>DCC, #2050G/ Hospital #0121 |
| <b>Office Location:</b>  | DCC, room#2050F (HSC)   | <b>Class Day/Time:</b> | T, 9:30AM-12:15PM                                       |
| <b>Instructor Phone:</b> | 419-383-5328  | <b>Credit Hours:</b>   | 3   |

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### SPECIAL COURSE EXPECTATIONS DURING COVID-19

#### ATTENDANCE

The University of Toledo has a missed class policy. It is important that students and instructors discuss attendance requirements for the course. Students must perform a daily health assessment, based on based on [CDC guidelines](#), before coming to campus each day, which included taking their temperature. Students who are symptomatic/sick should not come to class and should contact the Main Campus Health Center at 419-530-3451. *Absences due to COVID-19 quarantine or isolation requirements **are** considered excused absences.* Students should notify their instructors and these absences may not require written notice.

#### FACE COVERINGS

All students must wear face coverings while on campus, except while eating, alone in an enclosed space, or outdoors practicing social distancing. NO students will be permitted in class without a face covering. If you have a medical reason that prevents you from wearing a face covering due to a health condition deemed high-risk for COVID-19 by the Centers for Disease Control and Prevention (CDC), you should submit a request for an accommodation through the Student Disability Services Office (SDS) by completing the [online application](#). Students will need to provide documentation that verifies their health condition or disability and supports the need for accommodations. If a student is already affiliated with SDS and would like to request additional accommodations due to the impact of COVID-19, should contact their accessibility specialist to discuss their specific needs.

#### SOCIAL DISTANCING

Students should practice social distancing inside and outside the classroom please follow signage and pay attention to the seating arrangements. Do not remove stickers or tape from seats and/or tables, this is there to provide guidance on the appropriate classroom capacity based on the recommended 6 feet of social distancing between individuals. Please be conscious of your personal space and respectful of others. Also be cognizant of how you enter and exit the room; always try to maintain at least 6 feet of distance between yourself and others.

#### DESKS AND WORK SPACES

Students will need to sanitize their desks and/or work space before class with the University provided sanitizing spray and paper towels their desks.

#### SPECIAL NOTES

It's important to note that based on the unpredictability of the COVID-19 virus things can change at any time so please be patience and understanding as we move through the semester. I also ask that you keep me informed of concerns you may have about class, completing course work/assignments timely and/or health concerns related to COVID.



### **CATALOG/COURSE DESCRIPTION**

*This course provides an overview of the physical principles and instrumentation of the major medical imaging modalities including projection radiography, and computed tomography. In addition the course will present a general prospective on use of radiation in cancer treatment including discussions on basic conventional radiotherapy, advanced image guided radiotherapy and treatment planning.*

### **COURSE OVERVIEW/ TEACHING METHODOLOGY**

*The course offers the first introduction into the field of Medical Physics, and is a part of the BS in physics program with specialization in Medical Physics. The course is taught by the ABR-certified medical physicists from Radiation Oncology/Radiology departments on the HS campus (Drs. Parsai, Shvydka, Pearson, Sperling, and Aldoohan).*

*The course will be taught through regular lectures (partially through remote delivery with Webex or similar software), discussion of relevant approaches, and answering student questions. Each topic will be accompanied by a homework set.*

### **STUDENT LEARNING OUTCOMES**

*Upon completion of the course, the student will:*

- 1. Have an understanding of the basic physical principles of x-ray production, radioactivity and radionuclide production, and the interaction of radiation with matter.*
- 2. Understand characteristics of digital images including aspects of image quality such as spatial resolution, contrast, noise, and artifacts.*
- 3. Have developed an understanding of the basic instrumentation and processes for image formation in projection radiography, and computed tomography.*
- 4. Understands the applications of imaging in radiotherapy*
- 5. Will learn about treatment of cancer patients through external beam radiotherapy and the extensive related physical concepts in calculation of radiation dose to targeted volumes, as well as techniques to spare the healthy normal tissue through intensity modulated radiotherapy.*
- 6. Will develop an understanding of advanced techniques such as IGRT and Inverse Planning in radiotherapy applications.*

### **PREREQUISITES AND COREQUISITES**

*(Undergraduate level PHYS 2080 Minimum Grade of D- or Undergraduate level PHYS 2140 Minimum Grade of D-) and (Undergraduate level MATH 1760 Minimum Grade of D- or Undergraduate level MATH 1840 Minimum Grade of D- or Undergraduate level MATH 1860 Minimum Grade of D-)*

### **TEXTS AND ANCILLARY MATERIALS**

*W.R. Hendee and E.R. Rietnour, Medical Imaging Physics, Wiley-Liss, New York, 4th edition, 2002  
T. Pawlicki, D.J. Scanderbeg, G. Starkschall, Hendee's Radiation Therapy Physics, Wiley, 4th edition, 2016  
Additional supplemental reading materials and homeworks will be provided.*

### **TECHNOLOGY EXPECTATIONS**

*Students are expected to have basic computer skills.*



**ACADEMIC POLICIES**

Students are expected to comply with the standard UT policies including student conduct, academic dishonesty, missed class policy, student grievances, etc.

[http://www.utoledo.edu/law/studentlife/resources/handbook\\_policies.html](http://www.utoledo.edu/law/studentlife/resources/handbook_policies.html)

**COURSE EXPECTATIONS**

Attendance and class participation are expected; assignments will be accepted for full credit by the final exam date, no extra credit given

**OVERVIEW OF COURSE GRADE ASSIGNMENT**

Grades will be determined based on mid-term and final exams each carrying 50% of the final grade

The final letter grades are derived according to the following grading scale:

|        |       |       |       |       |       |       |       |       |       |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 90-100 | 85-89 | 80-84 | 75-79 | 70-74 | 65-69 | 60-64 | 55-59 | 50-54 | 40-49 |
| A      | A-    | B+    | B     | B-    | C+    | C     | C-    | D     | F     |

**UNIVERSITY POLICIES**

**Policy Statement on Non-Discrimination on the basis of Disability (ADA):** The University is an equal opportunity educational institution. Please read [The University’s Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance](#).

**Academic accommodations:** The University of Toledo embraces the inclusion of students with disabilities. We are committed to ensuring equal opportunity and seamless access for full participation in all courses. For students who have an accommodations memo from Student Disability Services, I invite you to correspond with me as soon as possible so that we can communicate confidentially about implementing accommodations in this course. For students who have not established affiliation with Student Disability Services and are experiencing disability access barriers or are interested in a referral to healthcare resources for a potential disability or would like information regarding eligibility for academic accommodations, please contact the Student Disability Services Office (<http://www.utoledo.edu/offices/student-disability-services/>) by phone: 419.530.4981 or email at [StudentDisability@utoledo.edu](mailto:StudentDisability@utoledo.edu).

**ACADEMIC AND SUPPORT SERVICES\***

Please follow this link to view a comprehensive list of Student Academic and Support Services (<http://www.utoledo.edu/studentaffairs/departments.html>) available to you as a student.

**SAFETY AND HEALTH SERVICES FOR UT STUDENTS\***

Please use the following link to view a comprehensive list [Campus Health and Safety Services](#) (<http://www.utoledo.edu/offices/provost/utc/docs/CampusHealthSafetyContacts.pdf>) available to you as a student.

**INCLUSIVE CLASSROOM STATEMENT**

In this class, we will work together to develop a learning community that is inclusive and respectful. Our diversity may be reflected by differences in race, culture, age, religion, sexual orientation, gender identity/expression, socioeconomic background, and a myriad of other social identities and life



experiences. We will encourage and appreciate expressions of different ideas, opinions, and beliefs so that conversations and interactions that could potentially be divisive turn, instead, into opportunities for intellectual and personal development.

**COURSE GUIDELINES**

*The regular class will meet once a week for lectures with individual consultations (remote or in-person) as needed. Communication via e-mail is encouraged; individual appointments will be available upon request*

**COURSE SCHEDULE**

| Week | Dates | Topic   | Instructor | Homework  |
|------|-------|---|------------|---|
| 1    | 08/18 | Introduction to HSC and tour Radiation Oncology                               | DS         |   |
| 2    | 08/25 | Basic physics of radiation (Ch. 2-3I)   | EP         | Ch. 2I:3, 4, 5, 6, 8;<br>Ch. 3I:1, 2, 4, 6, 8, 11, 12 |
| 3    | 09/01 | Interactions of radiation (Ch. 4I, Ch.2-3T)                                   | DS         | Ch. 4I: 3,5,6,9,11; Ch.3T: 4,5                        |
| 4    | 09/08 | Digital images and aspects of image quality (Ch.10T, Ch. 16I)                 | SA         | See HW set document                                   |
| 5    | 09/15 | Radiation quantity and quality, f-factor (Ch. 6I, 7I)                         | DS         | Ch. 6I: 1,3,5,6,12;<br>Ch. 7I: 3,5                    |
| 6    | 09/22 | Machines for producing radiation (Ch. 5I, Ch. 4T)                             | DP         | See HW set document                                   |
| 7    | 09/29 | Projection radiography (Ch. 13I)  | SA         | HW set document                                       |
|      | 10/06 | Computed tomography (Ch. 15I)   | SA         | HW set document                                       |
| 8    | 10/13 | MIDTERM EXAM  | DS/SA      |   |
| 9    | 10/20 | Measurement of ionizing radiation (Ch. 8I, Ch. 5T)                            | EP         | Ch. 5T: 4,6,9, 12<br>Ch. 8I: 1,2,3, 5                 |
| 10   | 10/27 | Calibration of Megavoltage beams of X-rays and electrons (Ch. 6T)             | DP         | See HW set document                                   |
| 11   | 11/03 | External beam treatment planning and delivery. TCP and NTCP concepts (Ch. 9T) | NS         | Ch. 9T: 2-5, 7  |
| 12   | 11/10 | External beam dose calculation for photon and electrons (Ch. 7T, 8T)          | DP         | See HW set document                                   |
| 13   | 11/17 | Tumor targeting, image guided and adaptive radiotherapy (Ch. 12T)             | NS         | Ch. 12T: 1-5 + additional Q set                       |
| 14   | 11/24 | Radiation Oncology Informatics (Ch. 10I, Ch. 14T)                             | NS         | Ch. 10I: 3, 4, 6<br>Ch. 14T: 3, 5, 7                  |
| 15   | 12/01 | FIANL EXAM  | DS         |   |

In chapter’s designation *textbooks: “I” for Medical Imaging Physics; “T” for Hendee’s Radiation Therapy Physics*