Science 353U & Physics 353 – *Radiation in the Environment*

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472 Science Research and Teaching Center, http://web.pdx.edu/~arice/index.php
Course website: https://d2l.pdx.edu/
Office Hours: Monday 2-3, Wednesday 2-3, Thursday 3-4, and by appointment
Lectures: Tuesday and Thursday 10:00–11:50, 101 SRTC

Course Description: Examines sources of radiation and the hazards they represent. Students will explore the interaction of radiation with matter, including living tissue, and examine dosage and risk assessment. Topics include: fundamentals of electromagnetic radiation, nuclei and radioactive decay; cosmic background radiation and radon gas; nuclear chain reactions, nuclear weapons and atomic bombs; nuclear power generation, waste disposal and nuclear disasters; medical x-rays and non-ionizing radiation from microwaves and cellular phones.

University Studies Cluster: *Science in the Liberal Arts Cluster* (SCI 353U only)
Cluster Goals: Understand and apply selected fundamental principles from one or more areas of scientific inquiry. Access and utilize scientific information and concepts in support of their life roles as individuals, citizens, learners, consumers, producers, and family members.

Required "Textbooks":
1. *College Physics,* Chapters 24 and 30-33, OpenStax College, 21 June 2012.
ISBN-10: 1938168003 http://cnx.org/content/col11406/latest/ (available on D2L)
2. *Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII – Phase 2, Committee to Assess Health Risks from Exposure to Low Levels of Ionizing Radiation,* National Research Council, 2006. http://www.nap.edu/catalog/11340.html (available on D2L)
3. Lynas, M., *Nuclear 2.0 Why a green future needs nuclear power,* UIT Cambridge Ltd, Cambridge, UK, 2013.
4. Lochbaum, D., E. Lyman, S. Stranahan, *Fukushima, The story of a nuclear disaster,* The New Press, New York, US, 2014.

Course Readings and Discussions: Weekly readings will come from the two books on the topic of nuclear power (Lynas and Lochbaum). Assigned each Thursday, after reading the assigned chapters you will be expected to address one discussion question from the reading. These responses will be turned in at the end of class the following Thursday and are expected to be no less than 250 words (typed and single-spaced). In-class discussions during the second half of each class period Thursdays will stem from these readings and questions. For this reason, c*lassroom attendance and participation is expected.* Late reading assignments will be not be accepted but your lowest assignment will be dropped from your final grade.

Research paper and presentation: During the quarter each student will be required to do an in-depth research project on a subject related to the course material. A brief ~1/2 page (min) abstract (summary) of your project including a short list of references is due Thursday, April 16 (week 3). Please feel free to discuss potential research projects with me during the first weeks of the quarter. **Rough draft of the paper is due Thursday May 5** (week 6). **The final research paper is due Thursday, June 2** (week 10) and should be **5-10 pages single-spaced** (12 point font, equivalent to 2000-4000 words). The paper should be fully referenced with primary literature sources (minimum 5-10). Finally, during the last two weeks of class each student will give a **5-10 minute presentation of your research** to the class (~3-5 powerpoint slides).

Midterm and Final Exams: Exams in this course will be based on material presented in-class and in the text books. Both exams will be take-home and open book but must be completed alone. Questions will be conceptual, quantitative and historical.
Midterm Exam: assigned Thursday April 21, **due Tuesday April 26** beginning of class
Final Exam: assigned Thursday June 2, **due Tuesday June 7** beginning of class
No late exams will be accepted.

Grading
Course readings and participation 30% (lowest score will be dropped)
Research paper 40% (30/10 split paper/presentation)
Exams 30% (equal weighting)

"News and Views" Extra Credit: You will have the opportunity to get extra credit by bringing in a current news story related to the topics covered in this course and sharing it with the class.

Academic Honesty: 'Academic honesty is a cornerstone of any meaningful education and a reflection of each student's maturity and integrity. The Code of Student Conduct and Responsibility, which applies to all students, prohibits all forms of academic cheating, fraud, and dishonesty. These acts include, but are not limited to: plagiarism, buying and selling of course assignments and research papers, performing academic assignments (including tests and examinations) for other persons, unauthorized disclosure and receipt of academic information, and other practices commonly understood to be academically dishonest.' – Portland State University Bulletin, General Catalog Issue, Vol. 49, 2015-2016.

Absence due to sickness – Due to concern about this year's flu season, if you are ill with flu-like symptoms please stay home for at least 24 hours after your fever is gone except to receive medical care. You will not be penalized for illness-related absences. If you will not be able to turn in an assignment or exam due to illness, please contact me via email or phone.

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Tentative Schedule (subject to change)
Week 1
Introduction to course; The atomic nucleus (30.1-30.3, 30.5)
Week 2
Radioactivity (30.4, 31.1-31.3); Electromagnetic radiation (24.3-24.4)
Week 3
Nuclear decay (31.4); Half life and activity (31.5)
Paper abstract due
Week 4
Nuclear energy levels and binding (31.6); Nuclear reactions (32.5-32.6)
Week 5
Midterm due Tuesday April 26
Doses of radiation (32.2)
Exposure from natural and manmade sources of radiation (BEIR VII – summary)
Week 6
Biological effects of radiation (BEIR VII – Chpt 2)
Effects of radiation at low doses (BEIR VII- Chpt 6-12)
Research paper rough drafts due Thursday May 5
Week 7
Radiation and medical imaging technology (32.1)
Radiation therapy and cancer treatment (32.3)
Week 8
Nuclear reactors and accidents Three mile island, Chernobyl and Fukushima Daiichi (32.6)
Nuclear weapons and atomic bombs (32.7); Nuclear fallout from weapons testing and use
Week 9
Research Presentations
Week 10
Research Presentations
Research papers due Thursday June 2
Week 11 *Final exam due Tuesday June 7*

Important course deadlines:
Midterm due Tuesday April 26
Paper rough draft due Thursday May 5
Final paper due Thursday June 2
Final Exam due Tuesday June 7

University deadlines:
Last day to add courses online April 3
Last day to drop courses with 100% refund April 3
Last day to drop course without a "W" on transcript April 9
Last day to drop May 15
Last day to change grading option May 15
Last day to submit degree application for summer graduation May 29